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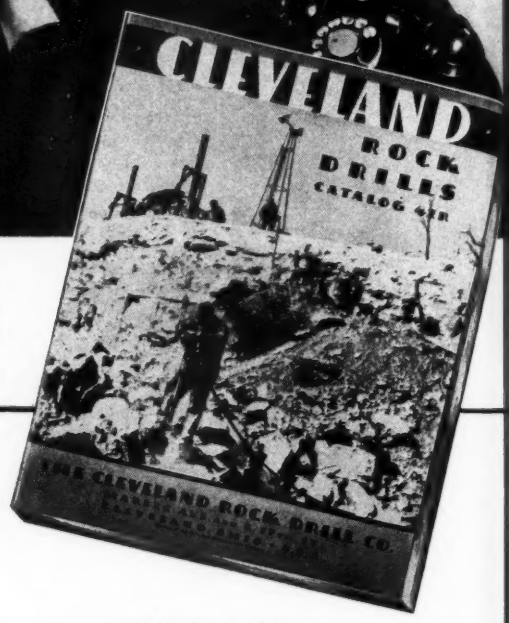

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A. PRESCOTT FOLWELL, Editor

JANUARY CONTENTS

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THE WAR EMERGENCY

Postwar Planning Delayed by Waiting for Federal Handouts

Too many municipal and state governing bodies are making no definite plans for financing postwar construction or even the planning for it, hoping the federal government will provide the funds in part if not wholly. To such we recommend a careful reading of an address by Col. William N. Carey, Chief Engineer, Federal Works Agency, before the Georgia Section, American Society of Civil Engineers. Among other things he said:

"Of course it is important that the people know at once what federal help, if any, may be offered for the accomplishment of the necessary preliminaries to a public works program. But that is a poor excuse for any live community to delay making definite plans now for the improvements it badly needs. . . .

"If federal aid in planning is forthcoming, it may well be that it would provide for a loan only, to be returned when construction was authorized. Any federal aid legislation is certain to impose conditions and limitations to which the borrower must conform. Because of all the uncertainties in the possibility of federal aid, and because of the urgency of getting public works plans under way now, it would seem that the argument is all on the side of not waiting for problematical federal action. . . .

"Apathy on the part of local subdivisions of government now may force the national government later to hand out from the federal cookie jar some hastily conceived, emergency-made work program. We should know by this time that such a program is certain to be wasteful of our money as well as non-contributive to permanent national prosperity."

Completed Plans for Postwar Work

At recent Congress hearings on public work planning, the Michigan Highway Department reported that on December 1st it had a planned program of some $70,000,000, with plans quite or nearly completed for $38,000,000 of this. Also 74 county road commissions had completed surveys and plans for approximately $13,243,000 worth of road and bridge work, out of a proposed program of $219,000,000. Forty-eight cities reported a total planned program as of December 1st aggregating $114,443,000. Detailed plans have been prepared for $17,668,000 worth of this local road, street, and bridge work.

Municipal Postwar Planning in New York

The New York State Legislature has created a State Postwar Public Works Planning Commission and appropriated $3,000,000 to assist municipalities in preparing plans for postwar public works projects, the municipality to furnish 50% of the cost. The commission has prepared a "Postwar Public Works Municipal Handbook" which outlines in detail the procedure for making an application for a state grant.

Equipment for Highway Maintenance

Discussing on December 2 the immediately pressing features of highway work, Thomas H. MacDonald, Commissioner of Public Roads, said:

"The next months must produce increased allocations of the requirements to serve land transportation, both rail and highway. We are facing a period of even more intensive maintenance. An immediate necessity already current in some sections, is preparedness for snow removal. Normally 534,452 miles are thus maintained, and a recent canvass of the States of their immediate needs, aggregates estimates of 2,551 trucks and 3,768 other pieces of equipment, totaling approximately $13,000,000 in value. In addition, a most critical need is an adequate supply of repair parts to keep existing equipment in reasonably continuous operation. Such an adequate supply, only to June 30, 1944, is estimated at $9,000,000. The Procurement Division of the Treasury is taking over all surplus equipment from Federal Agencies and will extend to the States the first choice of such equipment at agreed prices.

"Recently a communication has been addressed to General Somervell in command of the Army Service Forces by the Highway Traffic Advisory Committee requesting the assistance of the Zone Transportation Officers in passing upon and supporting the needs for winter maintenance equipment. Already considerable help has been given in this respect by these officers of the Transportation Corps, and we believe that this assistance is only at its beginning. It is with considerable assurance, then, that the recommendation is made that the State highway departments avail themselves, through the liaison representatives of the Highway Traffic Advisory Committee, of the sympathetic assistance of the Zone Transportation Officers in meeting problems of equipment and supplies."

Postwar Highway Employment

During the period from 1931 to 1942 an average of 282,216 man-years of labor was used directly on maintenance of federal and state highways. It is estimated that it will require a third more than this number for some time after the war to permit catching up with deferred work. For all categories of highway service in the postwar period, there is indicated an average annual need for the employment of 327,155 man-years on highway construction and 460,501 man-years on highway maintenance. The indicated minimum program necessary to accomplish this objective will require an estimated annual expenditure for construction of 1,690 million dollars and an additional 845 million dollars for maintenance.

Civilian Truck Production

WPB has announced a 200% increase in production of trucks for civilian use in 1944—from 41,779 to 123,492 units. (Normal prewar production was about 700,000 vehicles annually.) This program is a "must" with priority ratings equal to aircraft.

When you need special information—consult the classified READER'S SERVICE DEPT., pages 53-57

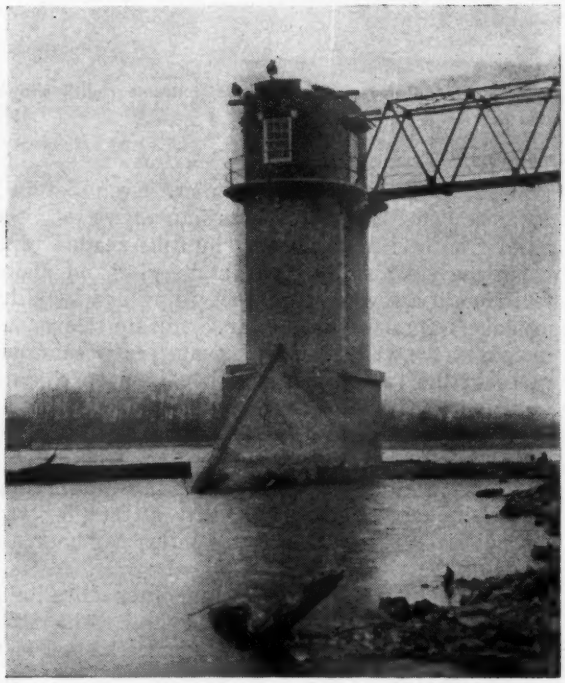
PUBLIC WORKS Magazine . . . JANUARY, 1944

VOL. 75. NO. 1

Returning a River Channel To a Water Intake

How the Kansas river, which had moved its channel away from Topeka's waterworks intake, was compelled to return; and what Topeka did in the meantime.

By LLOYD B. SMITH
Water Commissioner, Topeka, Kansas



Intake pier. Water very low. Sheet piling shown at the left.

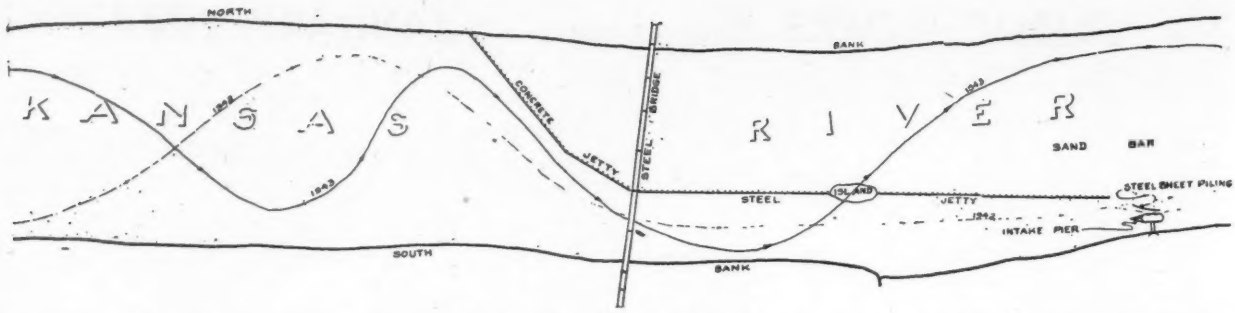
THE Kansas river, which is the source of water supply for the City of Topeka, Kansas, is a sand-bearing stream typical of many between the Mississippi and the Rocky Mountains. At Topeka the channel is about one thousand feet wide and the banks are about 24 feet high above the river bed. On an average of about once a year the river is bank full or running over, while during the dry season the gauge often drops to 2 or 3 feet. At low water the stream is only 200 or 300 feet wide and the remainder of the channel is a sand bar, often three or four feet higher than the surface of the water in the river.

During high water in the river the sand in the bed of the river moves down stream rapidly and the locations of these sand bars shift. The thread of the stream (that is, the part of the cross-section of the channel where the velocity is greatest) swings back and forth across the channel as the water flows down the river, due mostly to the curvature of the caving banks. Wherever this thread lies, there is the deepest water, and there only is water found when the river gets very low.

The intake pier of the Topeka water works is located near the south bank of the river. In order to hold the low-water flow along the south bank until it passes the pier, a concrete permeable jetty, or dike, has been installed from the north bank above the bridge to deflect the flow of water to the south bank, and another permeable jetty line of steel commencing at the river end of the concrete jetty and extending down stream, parallel with the south bank, to the intake pier. In this latter jetty line there was a sandy island 200 feet long, caused by a bridge span lodged there in the flood of 1903; but during the high water of the spring of 1943, the thread of the stream shifted so that the river current struck squarely against this island and washed it out. This resulted in the scouring of a deep channel along the north bank opposite the intake pier and the deposition of sand around the pier, forming a bar about half a mile long and seven hundred feet wide and reaching a height on the river gauge of about 4 feet.

Before the river had dropped below 9 feet on the gauge, this bar had formed around the pier sufficiently high to bring the bed of the river up to the intake gate. There were two Link-Belt moving screens installed in the intake pier, and sand poured into the intake and stopped the operation of first one of these screens, then the other. The sand then collected in the horizontal section of the suction pipes until it reduced their capacity 50 percent and two 5 mgd pumps running at top speed could furnish only four million gallons. At times water was being used at a rate greater than it could be gotten through the intake pier. This, with the danger of sand cutting out bearings and impellers, and with seventy thousand civilians and three war projects depending on city water as the only supply, had the water department plenty worried.

It was necessary to get this break in the jetty plugged while there was several feet depth of water over the sand bar surrounding the intake pier, so that sufficient water flowed there to move the sand and



Kansas river above the intake pier (extreme right), showing center of old and of new channel, the jetty, the bridge and the sheet piling at the pier.

scour a channel around the pier. Even before this could be done, however, it was imperative to get some relief from the sand running into the suction pipes.

On the river side of the intake pier and about 25 feet from it a row of steel sheet-piling had been driven to make a funnel with the large end up stream, which increased the velocity of the water as it came to the gates in the intake pier and kept a deep channel at this point when the river was low. The top of this sheet piling stood at about 2 feet on the gauge, as its action was needed only at low water. This piling now was buried under 2 feet of sand, which made the funnel ineffective and the velocity at the pier was the normal river velocity—about 4 miles per hour at this stage of the river.

Our first step was the installing, just above the sheet piling, of a retard of brush and steel to increase the velocity by the pier. This lowered the channel in front of the pier about one foot, but this was not enough for relief, so a 4-inch American Marsh centrifugal sand pump driven by a Continental motor was then installed on a barge and the sand pumped out between the intake pier and the sheet piling. This lowered the surface of the sand about 3 feet more, or to zero on the gauge. But the pump had to be run continuously, as the sand kept filling back in.

By this time the river had dropped to 5 feet on the gauge and sufficiently low to allow the driving of a row of Wakefield piling just back of the steel sheet piling and projecting above the water. This increased the velocity but, with the sand bar standing so high on all sides of the pier, it did not scour sufficiently to give relief, and the sand pump had to be kept in operation until such time as the bar could be washed away from around the pier by the natural flow of the river and the surrounding river bed lowered. This meant deflecting the thread of the river to the south bank and adjacent to the pier.

Lloyd B. Smith

Water Commissioner
Topeka, Kansas

A mile down stream and across the river, about two acres of 4-year old willows were found. From these, fascines were made and piled on top of each other to fill the gap in the jetty line through which the main channel of the river now flowed, using for this purpose a barge and a boat with an Evenrude outboard motor at the break in the levee and a motor boat with which to haul the willows. Each fascine was held down at its upstream end by a sand bag, the tops of the willows being placed down stream and not weighted, and was kept from floating down stream by being attached to a transverse cable stretched a short distance up stream from the butt ends of the fascines.

It took about a week to place the fascines. A sand bar commenced forming below as fast as the fascines were installed, and in another week the bar had practically closed the channel and a good velocity had developed by the intake pier. However, our troubles were not over, for the 4-inch pump still had to be kept in operation to keep the sand out of the pier.

As the river dropped on the gauge it was possible to determine by sounding that drift had caught along the front of the intake pier, a foot or two lower than the gates. For removing this, a dredging outfit was obtained consisting of a barge, an 8-inch Amsco centrifugal pump driven by a Climax gas engine, a LeRoi hoisting engine, and the necessary suction and discharge pipes. During the next four days a number of sunken trees and stumps were removed from in front of the intake pier and the channel lowered 8 feet. This filled back about 4 feet due to an old one-man-rock dike 100 feet above the intake pier, but there was no more trouble with sand in the intake.

A plan which was purely experimental was tried to remove this rock dike, using the 8-inch sand pump. The squared-off end of the suction pipe was left open, but cross bars were installed about a foot from the suction end, to keep rock from getting up into the pump. While the pump was in action, the suction was sufficient to draw small rock up into the suction pipe and to hold the larger rocks up against the end of the pipe as long as the pipe and rock remained submerged. In this way rocks were raised to just below the surface of the water, when a wire basket was slipped under the rock and the pump shut down. The rock then dropped into the basket and was removed. This was a slow process, but all the rocks finally were removed down to the sand bed on which they rested. (Incidentally, a buffalo skull was picked up 18 feet below the bed of the river. It has been about 90 years since there were buffalo along the Kansas river.)

Completion of the work described leaves the river channel adjacent to the pier in the best condition it has ever been since the pier was built.

Lake Forest Sewer Survey and Construction Of Relief Sewers

By NEIL N. CAMPBELL
City Engineer, Lake Forest, Illinois

Detailed description of the procedure of calculating sizes, grades, etc. of both sanitary and storm sewers to relieve and replace an outgrown system. Also construction features.

THE first public sanitary sewers in Lake Forest, Illinois, were designed in 1896. This system of sewers was planned to serve the then scattered population and was used in many cases as a general sewer to carry not only house sewage but the drainage from the property as well. These first sewers were extended from time to time as the city grew, until now practically all the area within the corporate limits lying east of Green Bay Road is served. As the population grew and the number of sewer laterals and connections increased, the main sewers, which were of small size and not carefully designed as to capacity, began to be flooded in certain areas, particularly during periods of heavy storm, due no doubt in part to the fact that storm water connections reach the sewers, and that basement footing wall drains were connected with the sanitary sewers in most cases. This flooding gradually become worse, so that in certain areas the sanitary sewers were seriously surcharged during practically every storm of any intensity or duration.

To correct this situation, a comprehensive survey of the entire sewer system of the city was made. A sewer map was prepared showing the existing public sewers, their size, the location of all manholes, the elevation of the tops of the manholes and the grade of the sewer at each. The city was then divided into drainage districts and showing the areas tributary to the existing main sewers and the areas to be served by new sewers. A careful study of the capacity of the existing sewers was made and tabulated and an estimate made of the probable amount of sewage that might be anticipated from the area, under the present zoning regulations.

With these data at hand, new sanitary sewers were designed to relieve or replace the existing sewers where they were found to be inadequate, and new storm water sewers were designed to serve areas where flooding was caused by the lack of adequate storm water facilities.

Deerpath-Illinois Road Drainage District

One of the districts considered for improvement was the Deerpath-Illinois Road drainage district, which includes approximately 105 acres, 91 acres in the residence district, and 14 acres in the business and commercial district. The Gorton School, located on the north side of Illinois Road just east of the Chicago North Shore and Milwaukee Railroad, the approximate center of the district, was the center of the area in which flooding occurred most often.

The first step in the study of this district was the preparation of a complete topographical survey and plot of the area, showing the land subdivisions, the streets, the existing improvements, pavements, road drainage, storm water sewers, sanitary sewers, water mains, gas mains, contours, etc. A good topographical survey is of inestimable value, for it supplies ready information on the shape and size of the drainage area, the average fall, the points at which the run-off concentrates, the distance water must flow to the concentration points, the basic information from which to determine the sewer grades and depth, and other information needed in the design of an adequate sewer system.

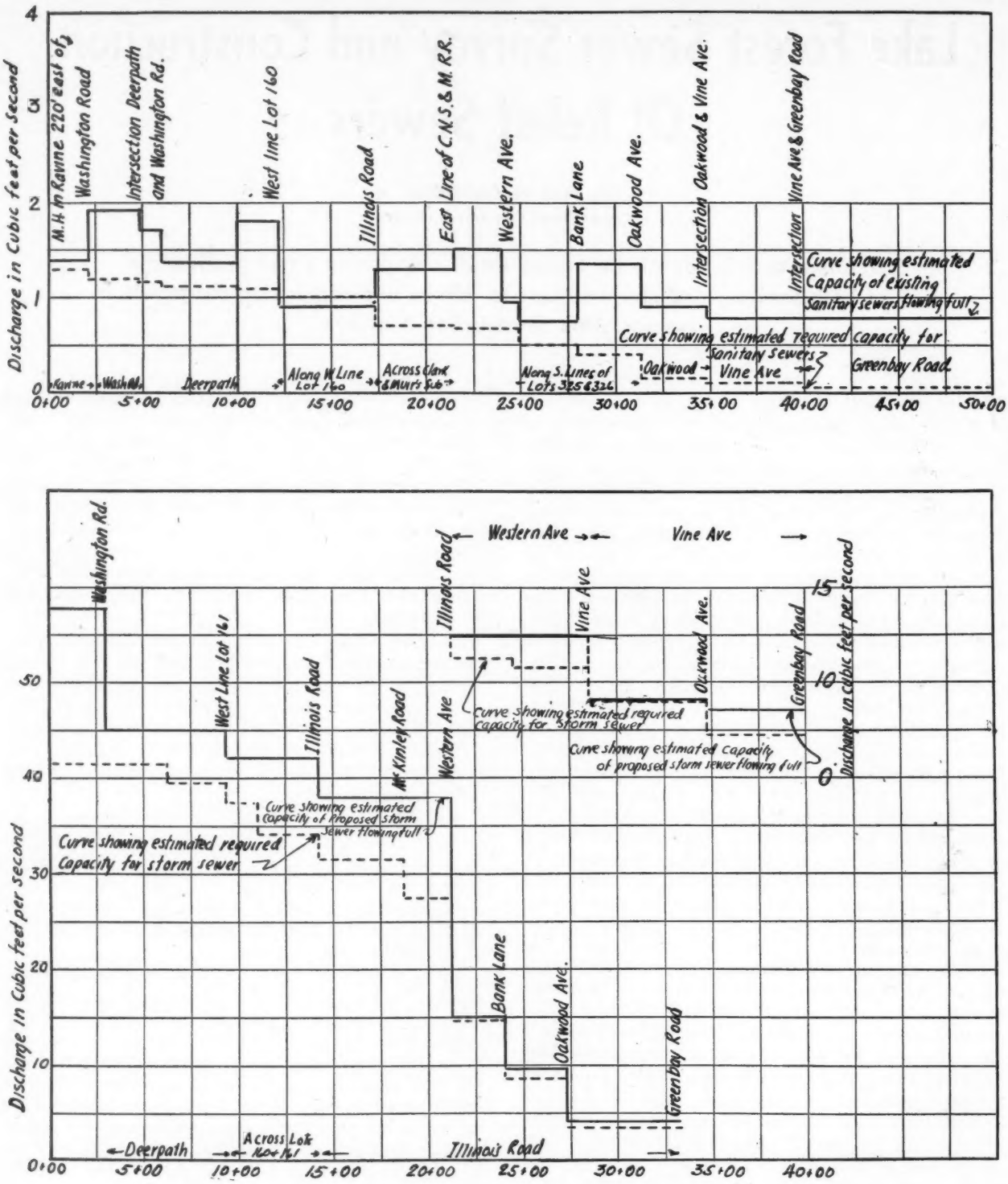
Sanitary Sewers: From the information supplied by the topographical survey and with the aid of the records on the existing sanitary sewers in the area, computations were made of the capacity of the existing sanitary sewers, and computations of the capacity required for a sewer to adequately serve the area when built up in accordance with the existing zoning regulations.

Table I shows the tabulated data pertaining to the sanitary sewers in this drainage area, including the location of the sewer, the distance between control points, the estimated tributary population, the estimated required capacity of a sewer to adequately serve the area, and the grade, size and estimated capacity of the existing sanitary sewers.

From a study of Table I, comparing the estimated required capacity with the capacity of the existing sewer, it is apparent that, with the exception of that section from Deerpath to Illinois along the west line of lot 160, the present sewer is large enough to serve the area when fully built up in accordance with the present zoning plan. Plate 1 shows in graphic form the estimated capacity of the existing sanitary sewers flowing full, and the estimated required capacity for a sewer to adequately serve the district.

Probably the most serious condition in the existing sanitary sewers is the inequalities in the design. Portions of the sewer show a capacity almost twice as large as the immediately adjoining section below. It is at these points where the extreme flooding takes place. The capacity of that section of the existing sewer along the west line of lot 160 from Deerpath to Illinois Road is 0.92 cubic feet per second, while the capacity of the section of sewer immediately above is 1.3 cubic feet per second, or 41 percent greater. It is, therefore, apparent that at times when the sewer is charged to capacity, the section of the sewer from Deerpath to Illinois Road cannot carry away the flow of sewage as rapidly as the section above will deliver it. The result is a flooded condition in the area.

The theory that an eight-inch pipe is an eight-inch



Upper—Plate 1. Estimated capacity of existing sanitary sewers and estimated required capacity. Lower—Plate 2. Estimated capacity of proposed storm sewers and estimated required capacity.

pipe and should carry as much water as any other eight-inch pipe regardless of its grade is responsible for more sewer trouble than perhaps any other factor, unless it is tree roots. In the design of a sewer system it is important that each section of sewer should have a capacity at least as great as the section immediately above and adequate to serve the entire drainage area above it.

Storm Water Sewers: The existing storm water sewers in this district consist primarily of small tile drains, mostly 4" and 6" in diameter, laid at a depth of 2½ to 3 feet below the edge of the pavement; a short stretch of 24" storm sewer across the grounds of the Gorton School, a 12" drain in Illinois Road, from Gorton School west to Oakwood Avenue, a short stretch of 24" pipe in Western Avenue between Illinois Road and Vine Avenue, and a few short stretches of small pipe in other places.

A brief study of the topographical map of the district and the computations with reference to the sanitary sewers made it apparent that if adequate storm water drainage facilities were provided the areas in distress would be completely relieved and flooding in the district eliminated.

TABLE 1

Sewer District in Vicinity of Deerpath and Illinois Road
Estimated Capacity of Existing Sanitary Sewer
and
Estimated Required Capacity for Sanitary Sewer

Estimate based on 400 gallons per capita per 24 hours, Residence District.

Location	From	To	Length	Tributary Population	Required Capacity C.F.S.	Grade	Existing Sanitary Sewer Size	Existing Sanitary Sewer C.F.S.
Ravine	220 East of Washington Rd.	Washington Rd.	220	2073	1.28	1.6%	8″	1.38
Washington	Ravine	Deerpath	268	1903	1.18	3%	8″	1.91
Deerpath	Washington	West	110	1878	1.16	2.4%	8″	1.71
Deerpath		West	420	1788	1.11	1.5%	8″	1.37
Deerpath		M.H.W. line Lot 160	212	1768	1.09	2.7%	8″	1.81
Along West Line Lot 160 Across Lots 1 to 7 Clark & Muir's Sub.	Deerpath	Illinois W. line Lot 1 Clark & Muir's Sub.	503	1608	1.00	0.7%	8″	0.92
Across C&N.W. and C.N.S. & M.R.R. Tracks	Illinois West line Lot 1 of Clark & Muir's Sub.	Western Ave.	423	1118	0.69	1.43%	8″	1.30
Western		South	234	1083	0.67	1.88%	8″	1.51
Along S. line Lot 325	Western	Bank Lane	101	1083	0.67	0.80%	8″	0.97
Along S. line Lot 326	Bank Lane	Oakwood	328	823	0.51	0.55%	8″	0.74
Oakwood	N.W. cor. of Lot 323	Vine	328	653	0.40	2.10%	8″	1.57
Vine	Oakwood	Green Bay	348	250	0.15	0.67%	8″	0.90
Green Bay	Vine	South	510	168	0.10	0.50%	8″	0.78
Illinois	S.W. cor Lot 160	McKinley	1240	80	0.05	0.50%	8″	0.78
Illinois	McKinley Rd.	Western	450	350	0.22	1.27%	6″	0.55
Illinois	Western	Bank Lane	245	200	0.12	1.04%	8″	1.11
			300	125	0.08	1.05%	8″	1.11
Investigation of Illinois Sanitary Sewer With the View of Carrying All Sewage Contributed West of Northwestern R.R.								
Illinois	S.W. cor. Lot 160	McKinley	450	1468	0.91	1.27%	6″	0.55
Illinois	McKinley	Western	245	1283	0.79	1.04%	8″	1.11
Illinois	Western	Bank Lane	300	990	0.61	1.05%	8″	1.11

TABLE 2

Sewer District in Vicinity of Deerpath and Illinois Road
Estimated Required Capacity for Storm Water Sewer

Estimate based on { Business Area 1.0 C.F.S. Run-off Per Acre. Residence Area 0.3 C.F.S. Run-off Per Acre.

Location	From	To	Length	Tributary Area Acres: Residence	Tributary Area Acres: Business	Required Capacity C.F.S.	Proposed Storm Water Sewer: Grade	Proposed Storm Water Sewer: Size	Proposed Storm Water Sewer: C.F.S.
Washington Rd.	Ravine	Deerpath	400	90.8	14.1	41.4	1.00	36″	57.7
Deerpath	Washington	West	320	90.8	14.1	41.4	1.70	30″	45.1
Deerpath		M.H.in Ravine	320	84.8	14.1	39.6	1.70	30″	45.1
Along W. line of Lot 161	Deerpath	South	160	77.6	14.1	37.4	1.50	30″	42.2
Across Lot 160	M.H. on W. Line Lot 161	West	150	67.7	14.1	34.4	1.50	30″	42.2
Along W. line of lot 160	M.H. 270′ N. of Illinois Rd.	Illinois	270	67.7	14.1	34.4	1.50	30″	42.2
Illinois Rd.	W. line Lot 160	McKinley	440	58.0	14.1	31.5	1.20	30″	37.9
Illinois Rd.	McKinley	Western	250	45.0	14.1	27.6	1.20	30″	37.9
Illinois Rd.	Western	Bank Lane	313	7.3	12.6	14.8	1.20	21″	17.0
Illinois Rd.	Bank Lane	Oakwood	313	7.3	6.2	8.4	2.4	15″	9.7
Illinois Rd.	Oakwood	Green Bay	600	7.3	1.2	3.4	2.9	*10″	4.0
Western	Illinois	Deerpath	380		2.7	2.7	2.2	*10″	3.0
Bank Lane	Illinois	Deerpath	490		2.9	2.9	1.0	10″	2.1
Bank Lane	Illinois	Vine	580		2.7	2.7	0.7	12″	2.8
Oakwood	Illinois	Deerpath	490	2.1	3.1	3.7	0.6	15″	4.8
Western	Illinois	South	335	38.3	1.0	12.5	0.6	*24″	14.8
Western		South	390	37.0	0.5	11.6	0.6	24″	14.8
Western	Vine	South	750	10.0		3.0	0.8	12″	3.0
Vine	Western	Oakwood	630	24.8	0.5	8.0	1.5	18″	12.5
Vine	Oakwood	Green Bay	530	15.1		4.5	1.4	15″	7.3
Oakwood	Vine	Illinois	600	4.7	0.5	2.0	0.5	12″	2.4
Illinois	W. line Lot 160	Easterly	700	10.0		3.0	0.8	12″	3.0
Deerpath	W. line Lot 161	McKinley	600	8.1		2.4	2.0	10″	2.8

*Existing.

On this assumption, the entire drainage district was divided into units with reference to the points at which the run-off would concentrate and would enter the main storm sewer. Table 2 shows the tabulated data pertaining to the proposed storm water sewers in the district, including the location of the sewer, the distance between control points, the estimated tributary area in the residence and business districts, the estimated required capacity of a storm water sewer to adequately serve the area, and the design for the proposed new sewer, showing the grade, diameter of pipe and the estimated discharge.

The proposed storm water sewer was designed to commence at and discharge into the ravine immediately south of Deerpath at the east line of Washington Road, and run in a general westerly direction to the intersection of Illinois Road and Green Bay Road. Also a branch runs in Western Avenue and Vine Avenue to Green Bay Road, and other branches in Oakwood from Vine to Deerpath, in Illinois from the Gorton School southeasterly to the south limits of the district, and in Deerpath from the west line of Lot 161 to McKinley Road. All existing drains or storm water sewers intersected along the line of the proposed sewer should be connected with the new pipe and provision made for future connections from private property and for street drains.

The design provides that the proposed new storm water sewer be laid at a grade below the grade of the present sanitary sewer so as to provide ample facilities for the abutting property owners to drain their basements into it and so that it will take up the ground water and relieve the sanitary sewers from infiltration as far as possible.

Plate 2 shows in graphic form the estimated required capacity for a storm water sewer to properly drain the district, and also a curve showing the design for the proposed sewer. This shows that in no case is the capacity of the proposed storm water sewer less than the estimated required capacity, and that the capacity of the sewer is regularly increased at concentration points to provide for all the storm water estimated to reach the sewer.

Construction: Two contracts were awarded for the construction of the proposed storm water sewer, one in September of 1941 to Santucci Construction Company, Skokie, Illinois and one in October, 1942, to Joseph A. Melloy, Libertyville, Illinois. The first contract included all of the 36″, 30″ and 24″ sewers in the systems, with connections from abutting properties and street drainage. The second contract provided for the construction of all the smaller sized main sewers and laterals, ranging in size from 21″ to 10″, in the area west of the railroads, connections from abutting properties, street drainage and all necessary manholes and catch basins. Surplus excavated materials were used to fill in an old ditch that paralleled the sewer, in which pools of stagnant wash water and street drainage had collected, become foul and were complained of by abutting property owners.

All 21″, 24″, 30″ and 36″ sewers were laid with reinforced concrete pipe. All other sewers and lateral connections smaller than 21″ were laid with vitrified clay, bell and spigot pipe.

The joints in the sewer were sealed with oakum and portland cement mortar. No attempt was made to secure absolutely tight joints, as it was intended that the sewer would pick up a reasonable amount of ground water by infiltration. The joints were reasonably well made, however, and sufficiently tight to prevent sand or sediment from entering the pipe. Care was taken to see that a sufficiently thick strand of oakum was laid in the bottom of the joint to center the pipe on the next adjoining one and secure a smooth flow line.

Manholes 3 ft. 6 in. internal diameter were located at all critical points and at intervals of approximately 300 feet, constructed with walls of concrete manhole

blocks and bottoms of portland cement concrete. The inverts in the bottom were formed by laying in the line of the sewer a split pipe or "Y" and extending the lateral connections with 45-degree curved pipes. The sides of the inverts were carried up to the elevation of the top of the sewer so as to retain the full flow of the pipe in the invert and not allow it to spread out over the bottom of the manhole, thus maintaining maximum velocity in the sewer, as it eliminates the swirls which develop in manholes with flat bottoms or shallow inverts, particularly at angle points.

The sewer trench was dug with a hoe-excavator, which was also used to lower and place the large sized pipes. Backfilling was done with a tractor equipped with an end shovel, which was also used to load surplus excavated materials and to grade the parkways after the trenches had been thoroughly flushed and settled.

The most serious obstruction to progress on this improvement was the service connections to the residences along the line of the sewer. These consisted of storm water drains, which had to be connected to the new sewer; sanitary sewer connections, water services, gas services, and telephone and electric parkway cable and ducts. All of these services had to be bypassed by means of short tunnels or, if cut or damaged, had to be repaired and restored to good condition. On one section of sewer 2306 feet long, there were 79 service connections or an average of one every 30 feet. These service connections have a very definite influence on the cost of construction and in estimating improvements in built up areas a liberal allowance must be made for the cost of bypassing them.

All pavements or parkways cut or damaged during the work of construction were restored to as good condition as they were in before the improvement was started. The pavements cut were bituminous macadam pavements. These were replaced with waterbound macadam ten inches thick surfaced with a bituminous mix, fine graded aggregate type, thoroughly rolled and neatly finished to exactly coincide with the existing pavement adjoining. The parkways were carefully graded, surfaced with good top soil and seeded and restored to as good condition as the average first class lawn.

Conclusion: During the construction of this improvement we had one storm of major intensity and duration. The old 24" storm sewer across the grounds of the Gorton School was discharging full at its outlet end and a heavy flow of water running over the surface of the ground. The new sewer was handling this entire flow satisfactorily. Since the completion of the improvement we have had several severe storms, and in all cases the new sewer proved adequate to handle all the water reaching it. There has been no flooding in the low places and no reports of flooded basements.

Small Septic Tanks Need Good Engineering

Many engineering crimes have been committed in the important but neglected field of small septic tank installation, causing operating troubles and unsanitary conditions. Probably an underlying cause of trouble is the exorbitantly large size of tanks required by so many state and city boards of health. This requirement results not only in excessive cost but also in bootleg installations by private individuals, contractors and others. Experience long ago showed that a tank of around 300 gallons is ample for an average one-family home, if it is properly installed and if the disposal field is properly constructed; proper construction here meaning ample area, correct slope, careful laying of the line, and provision of porous material based on absorption tests.

Many public health engineers seem to have an unreasoning dislike of commercial tanks, yet if these are properly designed they give excellent results, and it is much easier to bar from use low-grade tanks of this type than it is to prevent jackleg concrete contractors from putting in poor tanks of the built-in-place type. Also, by handling commercial tanks through plumbers, all of whom are licensed, a degree of control of installation is obtainable that cannot be reached in any other manner. This practice would at once eliminate many or most of the installations that no one knows about until they cause trouble.

It would be interesting to see what results would be obtained if some forward-looking state would inaugurate reasonable standards of size and encourage responsible licensed plumbers, under health department supervision, to install all such small septic tanks.

Postwar Plans of Louisiana Highway Department

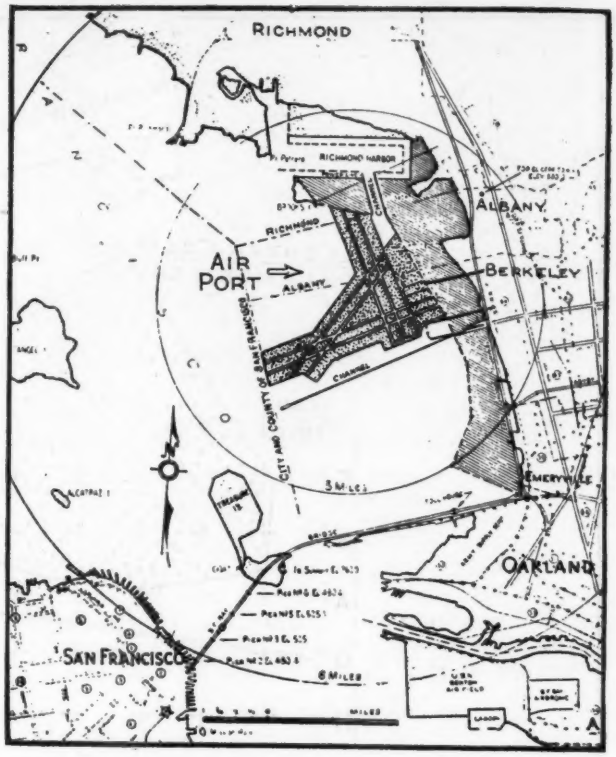
DURING the year 1943 the Louisiana Department of Highways made a beginning on surveys, design, and preparation of plans and estimates for postwar projects, spending $12,176 on the advance engineering work. According to the department's annual report: "An accelerated program, to the limit of ability of the curtailed highway forces, is expected during the year on the planning, survey, designing and preparation of plans for postwar projects. Louisiana has a tentative program of $208,000,000 of construction work covering a six-year period following the war. During 1944 the amount to be expended on postwar planning for this program is expected to amount to a total of approximately $433,280, divided into programs as follows: Advance engineering, $100,000; postwar investigations, $133,280; and postwar surveys, plans and estimates, $200,000."

"The cost of routine and extraordinary maintenance for the year 1944 on the maintained highway system of 14,523 miles, including work carried over from 1943, is estimated at $7,000,000. Every effort will be made to maintain the highway system to the highest possible standards and while it is proposed to expend for regular maintenance in 1944 approximately one million dollars more than the total expended in 1943, it is expected that the physical condition of the roads by the end of 1944 will still be further below normal standards than at the end of 1943. This additional deterioration is attributed to the curtailment of State funds available for this type of work and to the inability to replace surfacing or bridges that cannot be returned to normal conditions by regular maintenance operations.

"Funds available for highway maintenance and construction work during the year 1944, including both State and Federal funds, will total approximately $31,360,470. However, since the amount of new work will depend upon certifications by Federal agencies and availability of materials, equipment and labor, it is estimated that only $14,545,900 of this amount will be used for construction, maintenance and operation during the year and the balance carried over for future work. This amount is exclusive of any unforseen military access projects that may arise during the year."

The Proposed Golden Gate International Airport

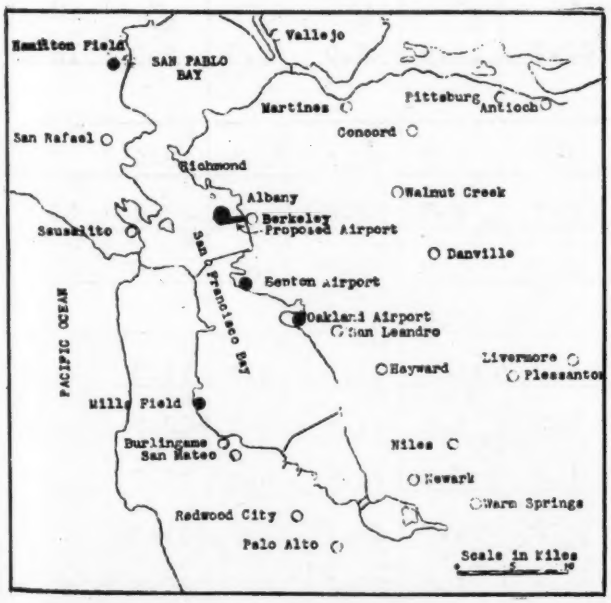
Plans for a 1400-acre airport to provide for international trade and benefit all the cities in the Bay area, providing a meeting place for air, rail and water transport.



General plan of the airport and surrounding territory.

BERKELEY, California, first constructed an airport in 1928. This, located on a 20-acre piece of ground, contained one runway 150 ft. wide and 1500 ft. long, aligned in the direction of the prevailing winds. This was leased to a company which erected a 3-plane hangar. This did not conform to Government standards and did not receive airport rating, but did serve as an emergency landing field.

At the same time preliminary plans were developed for a larger airport to be located on tidelands belonging to the city. This was not built at that time because of lack of funds. But in November 1940 the city made plans for an airport on these tidelands, located south of the Berkeley Municipal Pier, with an alternative location north of the pier. These plans contemplated the construction of four runways varying in length from 5,000 to 8,000 ft., located on an area 6,000 x 6,500 ft. The estimated cost if located south of the pier was $5,535,000 and if north of the pier, $9,753,000. The City Council submitted these plans to Washington and that north of the pier received favorable consideration, but the south location was less than six miles from an existing airport and therefore did not comply with the rules and regulations established by the Department of Commerce, Civil Aeronautics Administration.



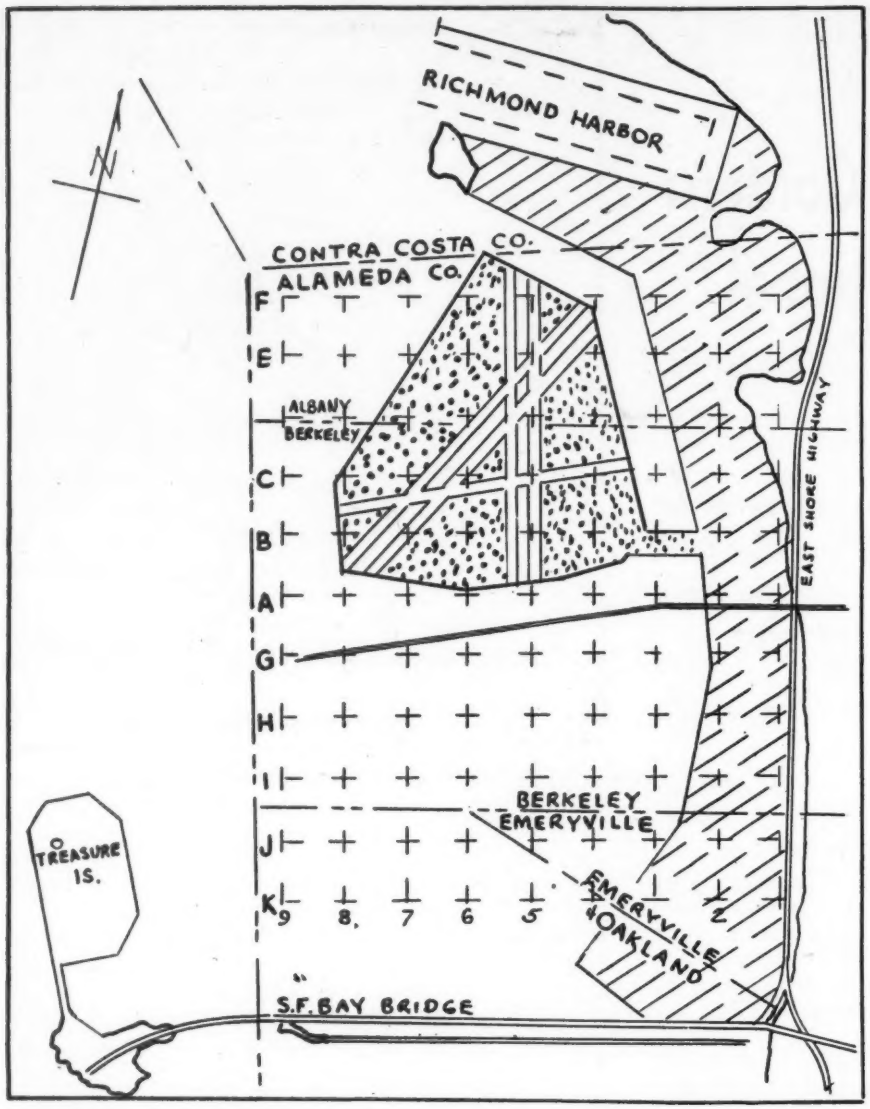
Map showing airports and cities within twenty-five miles of the airport.

In April 1943 plans were prepared for a larger airport to be located south of the pier, with four runways 8,000 to 10,000 ft. long; the construction of which would necessitate filling, by dredging, an area 9,000 x 6,500 ft. This location was again abandoned because of its nearness to an existing airport, and the present plans for a location north of the pier were then prepared and submitted.

These plans include the construction of a sea wall enclosing an area of 1400 acres, which would be filled in. Two runways will be located in a north and south direction, each 10,000 ft. long and 200 ft. wide, separated by a distance of 700 ft. center to center. Two runways 14,500 ft. long and 200 ft. wide will be located east and west, its alignment centering on the Golden Gate (entrance from the ocean to San Francisco Bay). The plans also include two parallel NE & SW runways.

The plans call for the extension of rail lines to connect with the nearby terminus of three transcontinental railroads and the ultimate development of a deep-water harbor in conjunction with the airport.

The depth of water at the airport site varies from 4 to 12 feet at mean low water. The fill will be made to the elevation of 14 ft. above mean low water, and it will be necessary to remove a layer of soft mud varying in depth from 3 to 10 feet. To retain this



Above—Location of borings for samples for soil data. Below—Table showing percentage of sand and mud in samples. Figures in squares give per cent of sand in mud. Letters indicate amount of sand in clay down to elev.-35. No letter indicates that there is no clay above elev.-35.

fill, a rock retaining wall will be constructed around the entire area. Before placing this rock, the mud below the wall will be excavated to a depth of 10 feet and replaced with sand, experience having shown that such a sand mat will prevent, to a great extent, any settlement.

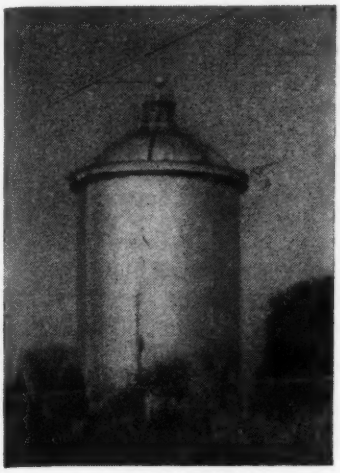
Drainage for the runways will be provided by the installation of catchbasins and pipe drains up to 24" in size, which will discharge into the bay at various points around the entire area. It is expected that there will be continuous and more or less uniform settlement of the filled area for several years, and that it will be desirable to use an asphaltic concrete surface on a rock base at first for paving the 265 acres of runways, ultimately to be replaced with portland cement concrete.

The Dept. of Commerce regulations require a clear level space on each end of each runway, free from obstructions, for a distance of 4500 ft., and the approach to the airport must be free of obstructions on a slope of one on forty. The location adopted may easily be made to comply with these regulations; and there appear to be few, if any, other locations in the Bay area more suitable for such an airport.

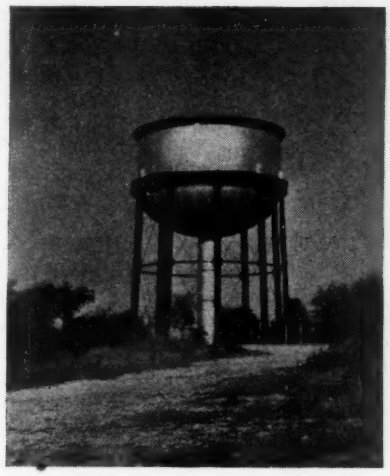
(Continued on page 30)

	A	B	C	D	E	F	G	H	I	J	K
1	S 73.7	S 40.5	S 25.8		S 44.3	30.3	S 12.6	S 2.0	M 2.0	S 2.0	T 18.5
1½		O 12.6									
2	S 27.5	S 11.9	S 8.2	2.0	O 0.6	4.7	S 5.0	S 40.0	M 29.0	M 15.2	T 3.0
3	S 43.8	S 22.0	5.8	1.0	2.0	0.7	S 2.7	M 22.8	M 5.0	S 34.4	S 42.5
4	M 15.0	M 7.3	9.5	1.0	3.2	3.0	S 5.0	M 2.0	M 12.0	M 10.0	S 32.9
4½							17.0				
5	M 0	M 7.7	7.0	2.1	2.0	0.2	T 11.8	M 15.5	M 18.0	M 14.3	S 22.0
6	M 5.0	M 2.0	S 18.2	2.0	0.3	1.7	M 3.2	M 11.8	M 18.8	M 22.5	M 20.4
7	M 8.8	M 12.6	S 44.3	12.6	1.5	1.4	M 8.6	M 16.4	S 26.8	M 18.2	M 34.2
8	M 17.3	S 19.4	M 10.6	6.5	0.5	0.2	M 21.8	M 16.7	S 25.3	M 21.5	M 40.0
9	M 18.0	S 4.4	S 12.5	6.7	0	0.1	M 21.6	M 26.3	S 14.0	M 28.2	S 30.0

O = No sand in clay down to elev.-35.0.
T = Trace (2%) of sand in clay to elev.-35.
S = Some (10% to 40%) Sand in clay to elev.-35.
M = Much (40% to 60%) Sand in clay to elev.-35.



2.5 million gallon standpipe.



1.0 million gallon tank for the north side.

1.5 million gallon elevated tank for the south side.

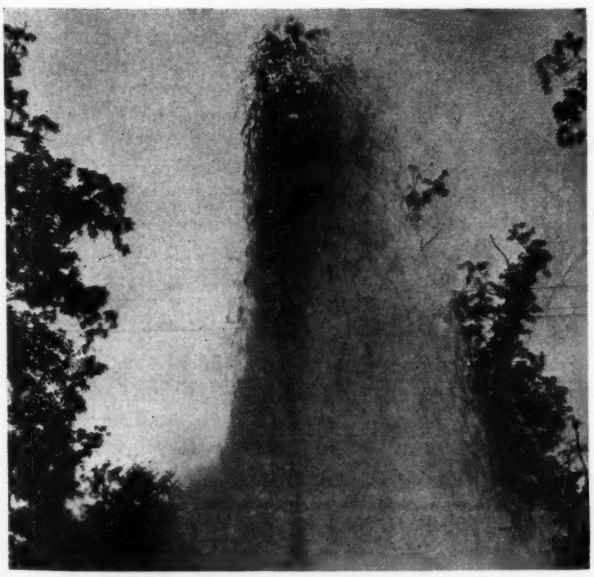
How San Antonio Solved a High-Service Problem

By W. D. MASTERSON

Manager, City Water Board, San Antonio, Texas.

Installation of two booster pumps, automatically controlled, saved laying miles of large mains to maintain the high-service pressure.

SAN ANTONIO, TEXAS, obtains an abundance of clear water from wells 600 to 1600 ft. deep in the porous Edwards Limestone. The wells are artesian with static heads of 655 to 690 feet above sea level; those at the Southside station, where the ground is comparatively low, spout 60 to 70 ft. in the air when first brought in. On the north side of the city, where the ground is higher, water does not rise to the surface and pumps are placed below ground level.



An artesian well "comes in" for San Antonio.

At the Southside station two electric-driven centrifugal pumps of 6 mgd and 8 mgd capacity are supplied by five wells. At the Main station, in the center of the town, two Allis Chalmers triple-expansion vertical steam engines of 20 mgd and 15 mgd capacity, and a 25 mgd steam turbine centrifugal, draw from 12 wells, all located within a few yards of the station.

The Northside station, also supplied by 12 wells, contains a 15 mgd and a 12 mgd Allis Chalmers steam turbine centrifugal pumps and a 12 mgd Terry steam turbine centrifugal, all set in a circular pit about 50 ft. in diameter and 45 ft. deep; also above ground near by are an Allis Chalmers 12 mgd deep-well motor-driven centrifugal and a 6 mgd Peerless deep-well pump driven by a Westinghouse motor. The deep-well pumps are seldom used except during exceptional peak loads but are available as reserves.

In addition there are six small independent electric centrifugal deep-well pumps, one a Byron Jackson submersible pump and the others either Victor or Peerless, scattered over the north side for use during heavy-load periods, which are automatically controlled by Mercoid pressure switches to come on and off as the local loads may demand; which seldom happens during the winter.

The only above-ground storage is furnished by a 1 m.g. Pittsburgh-Des Moines elevated tank on the north side, and a 2.5 mg standpipe and 1.5 mg elevated tank, both Chicago Bridge and Iron Company, on the south side. The tanks are all some distance from the pumping stations and are connected to them by

One of six automatic stations used to augment supply at North Side Station during heavy loads.

small copper pipes to operate gauges wihch indicate the height of water in them.

San Antonio is primarily a residential city. The consumption ordinarily averages 25 mgd, but we have rather long periods of dry weather in summer when consumption is often 50 mgd and reaches peaks as high as 100 mgd.

One section of the distribution system contains some rather unusual features. It is located in a new residential area where the ground elevation is a little too great for even the Northside station, which serves the higher areas of the city. At first, when there were only a few residences in this area, they were served by means of a small booster pump, a Dayton with a G. E. motor, installed in a small pump room under a sidewalk, where a 1400 gpm pump boosted the pressure about 20 pounds, being controlled by a mercoid switch so as to operate when load conditions caused the regular pressure to fall 10 pounds below normal, and to cut out when the pressure rose above the desired amount. This area built up to such an extent that this pump could not keep up the pressure with summer consumption.

This high area is fed by a 12″ main, which however ends about a half mile short of the location of booster pump referred to, and from there to the pump the main was too small to supply a larger pump, had one been installed there. Therefore a larger booster, a Cameron pump with Westinghouse motor, was installed at the end of the 12″ line. This worked fine when there was considerable load, but during periods of light load it caused too much pressure in the lower portions of this high area. To meet this situation, we valved off with checks the entire area fed by this 12″ main and installed a Foxboro flow rate control switch on the larger booster. Now, when the load increases in this high-service area and the normal pressure falls 10 pounds, the small booster comes on and is satisfactory until the consumption reaches about 1200 gpm, when it causes the control to start the larger pump; the increased pressure which it causes at the discharge of the smaller booster automatically cutting it out. When the load falls below 1200 gpm the larger booster cuts out and the smaller booster carries on as before.

This may sound rather complicated but it saves the construction of miles of large mains which otherwise would be required to keep up the pressure in this high-service area. The present arrangement works fine and there are no complaints of poor pressure in this area, which is now heavily built up with large homes which, in summer particularly, use lots of water.

San Antonio purchased the water system in 1925 for seven million dollars. It is now valued at over ten million, and two million of the original debt has been paid off although many rate reductions have been made since the city purchased the property.

The water system is controlled by a Board of Trustees, of which C. A. Goeth is chairman and James A. Gallagher, Lamar Seeligson and Martin Giesecke are the other members; the mayor, Gus Mauermann, also being a member of the Board with the same authority as other members except as to personnel. J. P. Newcomb is secretary; H. A. Koester is auditor; J. W. Eckles is superintendent, and Eugene Mattick and T. M. Benkley are chief engineers of the two steam stations, and G. A. Marbach is head of the collection department.

Common Use of Privately Constructed Sewer Line

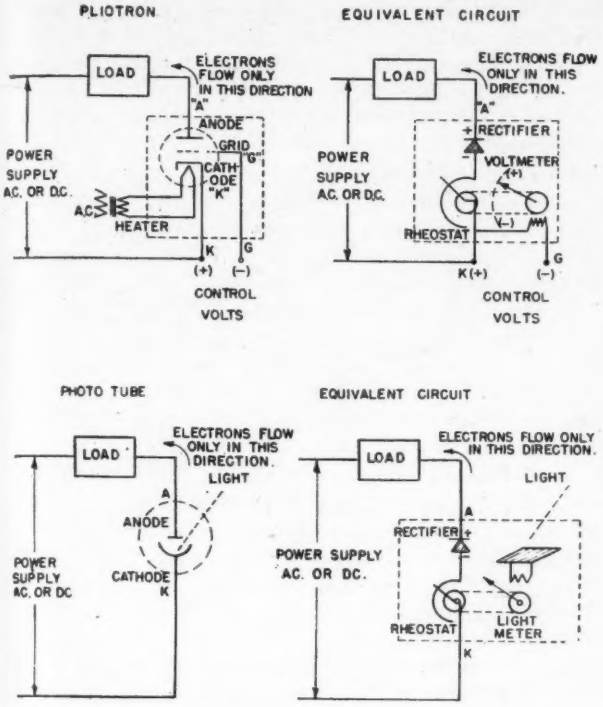
In an action against the mayor and councilmen of a city to restrain them from interfering with the plaintiff's use and enjoyment of a sewer line, the question was whether or not one who constructs a sewer line under a driveway or street, with the permission of the municipality, and without any reservation or restriction in the grant with respect to the use of the sewer line, may object to its use by other property owners where permission of the municipality is first obtained.

The South Carolina Supreme Court found the question not entirely free from difficulty and the authorities it had examined not entirely harmonious in principle. It found no case presenting the precise problem. If objection could be made to such use in such circumstances, each property owner along the driveway or street could be required to construct a separate sewer line to tap the city sewer. The fact that the property adjoining the driveway was not within the the city was held not very material. Possible extension of the city limits were to be considered, as well as the city's existing interests in such adjoining property and in the sanitary facilities connected therewith.

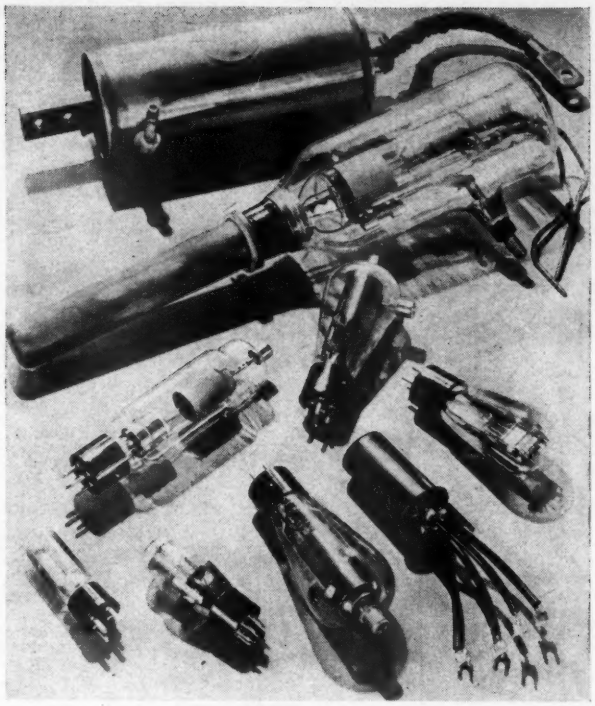
The court reversed judgment against the city. Disposing of the case on the precise issue of the legality of the city's act in granting permission to another property owner to tap the plaintiff's sewer line under the facts shown, the court rejected the contention which would give priority to private rights over the interests of the municipality in the operation and use of a sewer line which in the first instance could never have been constructed without the consent of the municipality and which, under the facts of the case, could be made available to other property owners without injury to the rights of the constructor of the sewer or his successors. The court based its conclusion on "an application of the fundamental principles that public grants will be narrowly construed so as not to extend them beyond the probable contemplation of the parties, and so as to negative any exclusive rights that would operate to the prejudice of the grantor or to the public generally."

While not controlling, the court pointed out that the plaintiff's sewer line had been almost wholly serviced by the city at its own cost.

There was no evidence that the permitted use of the sewer line would now or at any other time overload the line, or otherwise impair its use by the plaintiff. Glenn v. Woodworth, 14 S. E. 2d 555.



Above—Fig. 1—Pliotron operation and control, current is usually in milliamperes. Below—Fig. 2—Phototube operation and control. Light controls a flow of microamperes.



Tubes used in industrial electronics equipments: ignitron, pliotron, kenotron, thyratron, phanatron and phototube.

The Electron Tube—Genie, Gremlin, or Jeep?

By W. D. COCKRELL

Engineer, Electronics Section, Industrial Control Division, General Electric Company

How it operates, what it does, the various types in general use, and some of the uses to which they are being or can be put.

THE average engineer, unfamiliar with electronics, who glances through almost any magazine today is apt to be overawed by the promises of electronic things to come. Judging from these articles, the electron tube may seem to be nothing short of a genie straight out of the Arabian Nights—a superhuman spirit of fantastic complexity and far too elusive for the average mortal to comprehend. Or their odd appearance may seem to class the tubes with the gremlins. But on closer acquaintance the electron tube is found to be a friendly little jeep, rugged and reliable, capable of taking a terrific beating with minimum attention, while doing a man-size job.

Like the jeep, the electron tube can do its own job 100 per cent, but needs the assistance of the infantry of rheostats, transformers, and capacitors; and the artillery of motors, generators, and amplidynes.

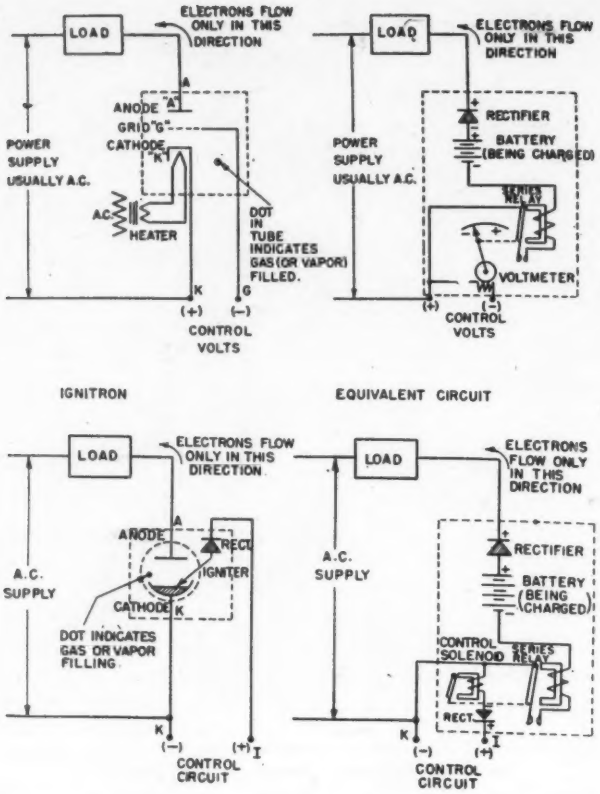
What Are Electron Tubes

Anyone who understands the use of the simplest copper-oxide rectifier*, the rheostat, and the direct-current voltmeter, can easily learn as much about an electron tube and how it functions in an industrial circuit, as many of us need to know.

In the first place, every true electron tube is a rectifier, composed of at least two elements or electrodes enclosed in a vacuum envelope made either of glass or of metal. One of the two principal elements of each tube is called a "cathode." The cathode is made of special materials, and is heated, usually by a small electric heater, to release electrons—fundamental particles of negative electric current.

Anything charged negatively attracts a positive charge and repels another negative one. Thus, if we connect the other principal tube element, called the "anode," to a power source so that it is positive with respect to the cathode, the anode will attract the electrons from the cathode. But if the cathode is positive and the anode negative, no electron flow will take place, because the anode is so made that it will prevent the loss of electrons. Thus, we get the one-way valve action of rectification; the electron flow (or the negative current flow, if you like to think of the normal current flowing from positive to negative,) can move in but one direction through the tube—namely, from cathode to anode.

*Rectifier, a device for converting an alternating into a direct current. *Rheostat*, a contrivance for regulating a current by means of variable resistances. *Voltmeter*, an instrument for measuring in volts the differences of potential between different points of an electric circuit; comparable to a manometer or U-tube in hydraulics.



Above—Fig. 3—Thyratron operation and control. Current rating is usually in amperes. Below—Fig. 4—Ignitron operation and control. Current may be in hundreds of amperes.

When the current is passing from cathode to anode in its simplest state, as a stream of electrons, we can control it easily. For the electrons in an ampere-second of current weigh about a billionth of an ounce and can be controlled much more easily with a small control power than even the smallest and lightest switch or contactor. The control element added to the electron tube for this purpose is called a "grid," which is usually a spiral or grate of fine wires placed between the cathode and the anode. If the grid is held at a negative potential with respect to the cathode, it tends to repel the electrons passing it on their way to the anode, thus cutting down the flow of current, or possibly preventing it altogether. So long as the grid is negative, it pushes the negative electrons away, and thus collects no electrons to itself. No electrons means no current, and no current—even with a large impressed voltage—means no power. And to be able to control current without the use of power is a neat job!

Of course, if we make the grid positive, it will assist the flow of electrons to the anode and a larger current will flow, but only at the expense of some electron current to the grid. With the grid negative, we can have control power for next to nothing.

Types of Tubes

The electron tubes that are used in industry may be divided roughly into three groups: phototubes, high-vacuum tubes, and gas-filled tubes.

Phototubes. A phototube is a simple two-element rectifier in an evacuated glass bulb. The cathode is not heated to release the electrons, but is made of material which releases or "emits" electrons as light strikes it. These electrons can then be attracted as a small negative electric current to the positive anode. The number of electrons which are emitted by the cathode material when light strikes a small cathode is very small; we are lucky to get a millionth of an ampere, in most cases, and under certain conditions the current is much less. In fact, the output is so small that, in order to make use of it, we must boost it up or amplify it with a pliotron or thyratron, in order to operate even the smallest practical relay or motor.

Phototubes are the "electric eyes" of industry. Responding to a shadow or a flash of light, they may be used to count people, food, freshly painted articles and other things which it is not desirable to touch, as well as to perform many other simple switching applications. In more advanced equipments, they can check or compare colors, read high temperatures, and control very rapid and accurate movements through the weightless and wearless light beams. The potential uses of the phototube are limited only by man's imagination.

High-Vacuum Tubes. Vacuum tubes which are simple rectifiers, and which have but two principal elements—the electron-emitting cathode and the collecting anode—are called kenotrons, or "diodes" ("di," indicating "two"). If we add one grid for the control of the electron stream, it becomes a "triode." All high-vacuum tubes with one or more grids are called pliotrons, or simply, amplifier tubes. Sometimes they are referred to by their function, such as transmitters, oscillators, or converters. If more grids are added in the electron stream to control the flow, like series valves in a pipe, the tubes may be called tetrodes (four-element, two-grid), pentodes (five-element, three-grid), etc. The typical vacuum tube is a low-current device which has a comparatively high voltage drop within the tube, yet it is capable of extremely fast and continuous control of the current with minimum grid power.

The pliotron is the familiar tube in radio receiving sets. Its role of amplifying a small signal or supplying a small output power is just as useful in industrial devices. Because of its characteristic of continuous control at extremely high frequencies, in the larger sizes it is used to supply the many kilowatts of power required for large broadcasting stations, or for induction and dielectric heating.

Gas-Filled Tubes. Gas-filled tubes, if used as rectifiers only, are called phanotrons; if they contain control elements, they are called thyratrons or ignitrons.

A *thyratron* tube has a hot cathode to emit the necessary electrons, and a grid to prevent current flow when desired; and also contains mercury vapor, obtained from a drop or two of mercury in the tube, or it may contain inert gas, such as argon or xenon at low pressure. The gas or vapor helps to cut down the high internal voltage drop found in the pliotron. A constant voltage drop of about 15 volts is held for any value of current within the ability of the cathode to supply electrons. (This is done by a process called ionization.)

Because of this low drop, a thyratron of a particular size can be rated for a continuous current of 10 to 20 times that of a pliotron of the same physical size. Thyratron current ratings run into amperes; most of the pliotrons with which we deal will carry continuously only a few milliamperes (thousandth of an ampere).

But gas filling does have a few drawbacks. For instance, the maximum voltage of the controlled circuit is limited, although it is still well above the usual industrial control voltage range. Of more importance to us is the fact that the gas prevents the grid from

(Continued on page 38)

A steel plate guard rail, non-tension type (Tuthill) in Illinois.

Right-of-Way Widths and Markings and Use Of Guard Rails By Counties

Data concerning county roads in 750 counties: Widths of right-of-way, and how the limits are marked. Kinds of guard rail used and mileage in the several counties.

A STUDY has been made by the Editors of PUBLIC WORKS in regard to width of right-of-way and methods of marking right-of-way limits in more than 750 counties representing every state in the nation except those in New England. Information was also obtained on the mileage of guard rails used on county roads. This information has been compiled by states. It should be borne in mind that *only county* roads are included, and not township or state roads.

Alabama. — Average county road mileage in 5 counties was reported as 1025. Rights-of-way varied from 25 ft. to 60 ft. minimum. One of the 5 counties marked RW limits, using wood posts. The 5 counties reported a little over 6 miles of guard rail.

Arizona.—Mileage per county averaged 425; RW widths are 60 ft. or more; only 1 of 4 counties reporting mark the limits, this one (Apache) using post monuments and fence. None has guard rail on county roads.

Arkansas.—Eight counties report an average of 510 miles of county road; RW widths are 40 ft. for one county, 50 ft. for 3 others, and 60 ft. or more for the remaining 4. Four mark RW limits; 3 with markers and 1 with fence. About 9 miles of county guard rail are reported.

California.—Twenty-six counties reporting; average mileage is 1290. RW widths are as follows: 40 ft., 10; 60 ft., 14; 20-24 ft., 1; 80 ft., 1. Limits are marked wholly or in part by 13, using a variety of methods, including steel pins, pipes, fences and permanent monuments. About 75 miles of guard rail are reported by the 26 counties, but some reports are indefinite and the total may be greater. One county uses only posts; another uses guards only on bridges and approaches.

Colorado. — The least RW width reported by 6 counties is 60 feet and in a number of cases it is 100 ft. Mileage averages about 475 per county. One fences its RW; none uses guard rail.

Florida.—An average mileage of 575 miles is reported by 9 counties. With one exception RW widths exceed 50 ft. One county marks limits with iron pipe and one with fence. In this level section, guard rails are not considered to be necessary except as bridges.

Georgia. — Average road mileage is 575 for 11 counties. RW widths are 24 ft. (2 counties), 30 ft. (3), 40 ft. (2), 60 ft. (2) and 80 ft. (2). Four mark RW limits with concrete posts; Muskogee sets these so they are within sight of each other. Three counties report small amounts of guard rail.

Idaho.—Nine counties; average mileage, 775. RW widths range from 50 to 100 ft. Five fence and 2 mark RW limits. A total of 52 miles of guard rail is reported.

Illinois.—Forty-five counties report an average of 415 miles of county road. RW widths are quite uniformly 66 ft., though many other widths are reported, a few narrower but most of them wider. RW limits are marked by 37 counties, but several of them have recently started to do so and presumably not all roads are yet marked. Concrete posts or markers are almost entirely used for this purpose. Nearly 200 miles of guard rail are reported by the 45 counties.

Indiana.—In 33 counties the average mileage is 750; RW widths under 40, 13; 40 ft., 17; over 40 ft., 13. Relatively few RW limit markers are reported. Indiana is a fenced and built up area and farm fences usually mark the edges of the RW. 138 miles of guard rails are reported.

Iowa.—In 67 counties reporting the average mileage is 765; RW widths are almost uniformly 66 ft. Relatively few counties mark RW limits; a few use iron hubs or place markers at corners. About 110 miles of guard rail are reported; Iowa is a level area.

Kansas.—In 87 counties reporting the average mileage is 371; RW widths generally 60 ft., with a few less than this and several greater. Very few counties mark RW widths. Only about 75 miles of guard rail are reported, many counties stating ground is "very level."

Kentucky.—In 18 counties reporting the average mileage is 380; RW widths very variable, ranging from 14 ft. and 16 ft. up to 50 or 60 ft.; however, most counties report widths of 30 to 40 ft. RW limits are reported as marked by fences in 2 counties and by stakes in 1. About 11 miles of guard rail are reported.

Louisiana.—Four parishes; average mileage 300; RW widths in 3 parishes are 60 ft. and in La Salle parish 78 ft. West Baton Rouge parish marks RW limits with concrete monuments. No guard rail is reported.

Michigan. — Thirty-six counties; average mileage 988; 66′ is the average width of RW, one reported 50-66′, and two report a width of 24′. Very few counties mark RW limits; several use fences, and one each use concrete markers, stakes, white wood posts and road end signs. A total of 888 miles of guard rail are reported, 360 miles of this by one county, 200 miles by another and 125 by a third.

Minnesota.—Seventy-one counties report an average of 493 miles. One county reports a RW limit of 22-40′, another 24′, and another 26′; the average width is 66′. Several others report widths of from 66′ to 132′. One county states the backslope is 17′ outside of RW, and another reports that it constructs slopes outside of RW limits. In only a few counties are the limits marked; 8 use fences; 1 stakes; and 1 laths. 335 miles of guard rail are reported.

Mississippi.—Average road mileage for 7 counties is 395 miles; RW width average is 50′, with the exception of two counties, one reporting a width of 30′ and the other 40′. No RW limits are marked. One county (Coahoma) reports ¼ mi. of guard rail.

Missouri.—In this state 20 counties reporting average a mileage of 578. RW width varies from 30′ to 60′; one county reports 70′ (new). Only a few counties mark the RW limits, and these are by stakes or property fences; in one county the state roads are marked by concrete markers. One county reports 5 miles of guard rail and in another county it is used only on state roads.

Montana.—In 17 counties reporting the average mileage is 1015. RW width average is 60′; however, one county reports a width of 16′, another 24-30′, and another, 40-100′. Several counties use fences to mark the RW limits, one stakes and pins, one rocks, and one roadstone at angles. 34½ miles of guard rail are in use.

Nebraska.—The average mileage per county reported for 23 counties is 666. The average RW width is 66′, but a few report smaller widths of 24′, 26′ and 33′. About half of the counties mark RW limits —fences, stakes, cement markers, and concrete posts are most commonly used for this purpose. A total of 24 miles of guard rail is reported; several counties state that a small amount is used.

Nevada.—Six thousand miles of roads are reported by Elko County. RW width is 60′; the RW limits are not marked. Practically no guard rail is used by this county.

New Jersey.—Ten counties; average road mileage is 307. RW width varies from 33′ to 66′. Five counties use concrete monuments to mark the limits. The amount of guard rail reported is 152 miles.

New Mexico. — San Miguel County reports 365 miles of county roads. RW width is from 30′ to 80′; no RW limits are marked. The guard rail is placed by the State Highway Dept.; no figure for amount in use was reported.

New York.—The average mileage in 26 counties reporting is 307. RW width varies from 40′ to 120′; the average is 49½′. The RW limits are marked by wire fencing, concrete markers, concrete posts, stakes and concrete monuments. About 733 miles of guard rail are reported.

North Dakota. — Average road mileage for 12 counties is 411. RW widths of from 66′ to 100′ are reported. The RW limits in several counties are marked by the use of stakes. A total of 11 miles of guard rail is reported.

Ohio.—Forty-three counties; average road mileage is 465. The RW width ranges from 30′ to 60′; the average is 60′. A few counties mark the RW limits with stakes, concrete markers or monuments, and concrete posts. The amount of guard rail in use is 549 miles.

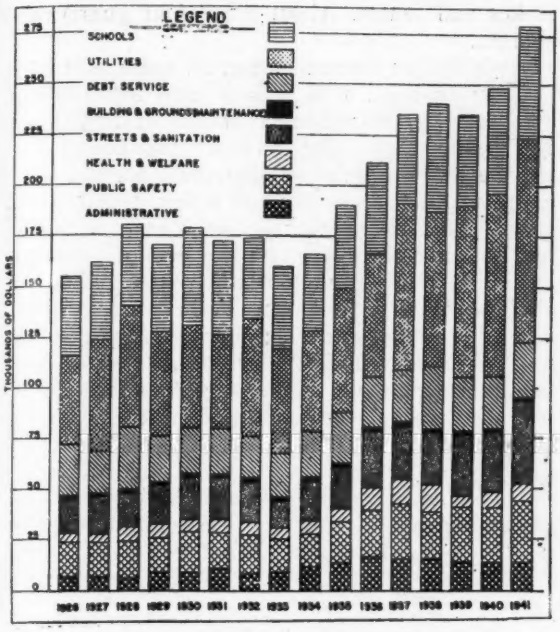
Oklahoma. — Mileage per county reported by 21 counties is 1345. RW widths range from 33′ to 66′. except for two counties which report 70′ and 100′ respectively. A few counties mark the limits by stakes. fences, steel rods, and concrete markers. The amount of guard rail reported is 38 miles; several counties state that "a few miles" is in use.

Oregon.—Average road mileage in 21 counties is 1055. RW widths are from 40′ to 60′, with the exception of two counties which report minimum widths of 24′ and 30′ respectively. About one half mark the RW limits, using white iron posts, fences, stakes, iron markers and pins, About 13 miles of guard rail are reported; some report "short pieces," "very little," "indefinite," etc.

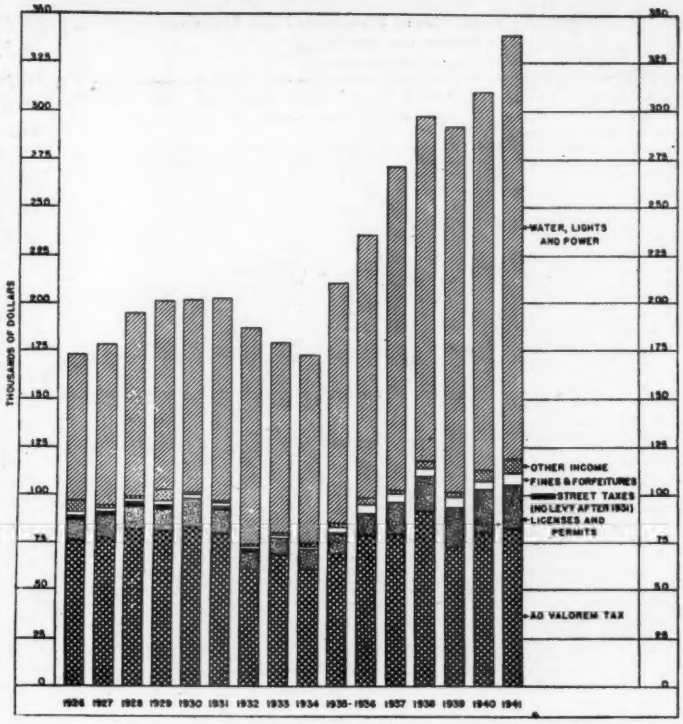
Pennsylvania. — Six counties reporting; average road mileage 29. RW widths are from 18′ to 50′. One county marks RW limits by signs. The amount of guard rail reported is 44 miles.

South Carolina.—The average county road mileage for the six counties reporting in this state was 2,020 miles. The RW width ranges from 30′ to 50′. Two counties mark the RW limits, one by ditching and the

(Continued on page 26)



Cumulative operating expense, 1926-1941.



Cumulative revenue, 1926-1941.

Moultrie's Long-Range Improvement Program

A thorough and detailed six-year program by a city of 15,000, including not only physical improvements but also increases in personnel and the means of financing.

Moultrie, Georgia, has a population of about 15,000. In 1900 the population was 2,221; in 1940 it was 10,147. Recent growth has been due largely to war activities in and near the city. It owns its waterworks and electric distribution system, and the revenues from these average 57% of the city's total revenue for the years 1926-1941.

An unusually thorough and detailed long-range program of public improvements for the city was prepared in 1941 by City Manager Geo. A. Shaver, with the assistance of the Local Public Works Programming Office of the Federal Works Agency, and published in an attractive 37 page pamphlet, a prominent feature of which is tabulation of data supporting the statements of the report, and the plotting of the same on 8 diagrams. The facts and recommendations may be of interest to other cities planning post-war improvements and are abstracted below.

The report includes recommendations for not only physical improvements but also additional expenditures for services, for which provision is made in the financing scheme developed. For example, in the Water and Light Dept., provision is made for an additional $36,300 (spread over six years) for personnel and maintenance as well as $400,876 for capital improvements.

The total revenue from each source for the past six years was plotted, and the curve extended six years ahead, in arriving at the funds assumed to be available. The 1941 revenues were as follows: Ad valorem taxes, $82,359; licenses and permits, $23,932; fines and forfeitures, $5,405; water, $36,240; electric, $182,802; other income, $7,296. The total expenditures were $277,808, leaving $60,225 available for capital improvements.

The estimate of revenues and expenditures during the next six years showed the net available for capital expenditures to increase more or less uniformly from $74,398 in 1942 to $112,824 in 1947.

Moultrie's policy has been to finance major public improvements by sale of bonds, a sinking fund being maintained for retiring them. The sinking funds will, it is estimated, require a levy of 3 mills in 1943 and 1944 and 4 mills for the next five years; after which the levy to meet existing bond requirements can be reduced until 1953, when all will have been retired.

Having determined the amounts presumably availble each year for the next six years, the needs of each department of the city government were listed and scheduled in an order that took into account present facilities and general requirements for the protection, health, convenience and comfort of all the citizens.

Summary of Proposed Capital Improvements and Additional Services and Operations
City of Moultrie, Georgia

Department—	Amount	1942	1943	1944	1945	1946	1947	Later
Water and Light Department:								
Capital Improvements	$ 400,876	$ 26,030	$ 34,938	$ 22,069	$ 14,495	$ 42,150	$ 23,747	$237,447
Personnel and Maintenance	36,300		4,740	6,540	8,340	8,340	8,340	
Departmental Total	437,176	26,030	39,678	28,609	22,835	50,490	32,087	237,447
Streets and Sanitation:								
Capital Improvements	454,567	36,648	55,528	59,578	51,053	44,977	46,783	160,000
Personnel and Maintenance	70,360	3,620	7,240	11,860	15,480	16,080	16,080	
Departmental Total	524,927	40,268	62,768	71,438	66,533	61,057	62,863	160,000
Police Department:								
Capital Improvements	31,400							31,400
Personnel and Maintenance	27,480		2,850	4,155	5,490	6,825	8,160	
Departmental Total	58,880		2,850	4,155	5,490	6,825	8,160	31,400
Fire Department:								
Capital Improvements	28,990	2,500	7,000	8,400				11,090
Personnel and Maintenance	45,280			11,380	11,300	11,300	11,300	
Departmental Total	74,270	2,500	7,000	19,780	11,300	11,300	11,300	11,090
Public Facilities:								
Capital Improvements	440,000	340,000						100,000
Departmental Total	440,000	340,000						100,000
Moultrie Carnegie Library:								
Capital Improvements	19,600				19,600			
Personnel and Maintenance	18,290				4,980	4,980	4,980	3,350
Departmental Total	37,890				24,580	4,980	4,980	3,350
Board of School Commissioners:								
Capital Improvements	144,400		5,400				24,000	115,000
Personnel and Maintenance	75,535		5,970	7,470	14,650	14,650	17,050	15,745
Departmental Total	219,935		11,370	7,470	14,650	14,650	41,050	130,745
Totals:								
Capital Improvements	1,519,833	405,178	102,866	90,047	85,148	87,127	94,530	654,937
Personnel and Maintenance	273,245	3,620	20,800	41,405	60,240	62,175	65,910	19,095
PROGRAM TOTAL	$1,793,078	$408,798	$123,666	$131,452	$145,388	$149,302	$160,440	$674,032
Provision for Financing Programs:								
Abutting Property Owners	307,603	13,400	28,400	27,700	27,817	24,700	25,586	160,000
Civil Aeronautics Authority	321,000	321,000						
Bd. of School Commissioners	75,535		5,970	7,470	14,650	14,650	17,050	15,745
Moultrie Carnegie Library	18,290				4,980	4,980	4,980	3,350
City-Current Funds	1,070,650	74,398	89,296	96,282	97,941	104,972	112,824	494,937
FINANCING TOTAL	$1,793,078	$408,798	$123,666	$131,452	$145,388	$149,302	$160,440	$674,032

Data were prepared on the basis of which the city might, if it desires, finance the extension of water services by issuing revenue anticipation certificates, the proceeds from which would be used to construct an elevated storage tank and city-wide extensions to its distribution system. This schedule provides for an issue of $125,000, the principal of which would be paid off by 1970 at a rate that would require an annual debt service gradually increasing from $3,750 to $8,240. Aside from the tank and extensions, expenditures for the water department are scheduled at $15,230 in 1942, $13,000 in 1943, and $14,150, $7,695, $11,000 and $15,000 in the succeeding years, for the distribution system; also $13,800 in 1943 for a reservoir and $24,150 in 1946 for reservoir and pumping equipment. Also provision was made for adding a lineman, lineman-helper, a plumber and a meter reader in 1943, and for increasing the additional linemen to 2 in 1944 and 3 in 1945.

In the same way improvements were scheduled for the Department of Streets and Sanitation (sewers, paving and street cleaning), for the Police, Fire and Public Facilities Depts., the public library and schools. The only item under "Public Facilities" was $340,000 in 1942 for an airport, of which the Civil Aeronautics Authority was to provide $321,000. A summary of the proposed capital improvements and additional services is given in the accompanying table.

Right-of-Way Widths and Markings, and Use of Guard Rails by Counties

(Continued from page 24)

other by concrete posts. A total of 3 miles of guard rail is reported.

South Dakota.—The average mileage for the 24 counties reporting is 334. RW widths vary from 66′ to 100′, with the exception of 4 counties which report a width of 24′ each. RW limits are marked in a few counties by fences and stakes. The amount of guard rail reported is 104 miles.

Tennessee.—Twelve counties; average mileage is 983. Average width of RW is 30′ to 60′; one county reports a minimum width of 14′. A few mark limits with stakes and fences. About 9 miles of guard rail are reported.

Texas.—Nineteen counties report an average of 749 miles of county road. RW widths vary from 30′ to 80′; 3 counties report maximum widths of 100′, 120′ and 150′ respectively. The majority use fences for marking the RW limits; concrete monuments and concrete posts are used by others and a few do not mark the limits. The total number of miles of guard rail reported is 34; some report that the amount is negligible, and in one county guard rail is used at ends of bridges only.

Utah.—The average for six counties reporting in this state was 621 miles. RW width average is 66′. Two counties mark the RW limits, one by fences and the other uses monuments. About 3 miles of guard rail are reported.

Virginia. — Average county road mileage in 7 counties is 433. RW widths vary from 30′ to 50′; one reports a width of 80′. All but one county mark the RW limits, using iron pipe, concrete posts, monuments and markers, and fences. The amount of guard rail reported is 10½ miles.

Washington.—Mileage per county averages 860 for 26 counties. RW width average is 40′ to 60′; one county reports a minimum width of 20′ and another 30′. Several use fences to mark the RW limits, a few use stakes, and two use monuments. A total of 78 miles of guard rail is reported.

West Virginia.—Eight counties; average mileage is 592. Average width of RW is 40′ to 60′; three report 30′ on secondary roads. Two mark RW limits, one with concrete posts and the other with RW markers. The amount of guard rail reported is 201 miles.

Wisconsin.—Average road mileage is 279 for 27 counties. About one half of the counties report the width of RW as 66′; several have widths of 49.5′, and three report minimum widths of 24′, 26′ and 28′ respectively. One county has a maximum width of 120′, and another states the width for new roads is 200′. RW limits are marked in a few counties by fences, posts and concrete or iron stakes. About 183 miles of guard rail are reported.

Wyoming.—Eight counties reported; average mileage is 1406. RW width ranges from 66′ to 100′. RW limits are marked by iron stakes with stone markers, fences, and iron pipe. Three counties report a total of 2½ miles of guard rail.

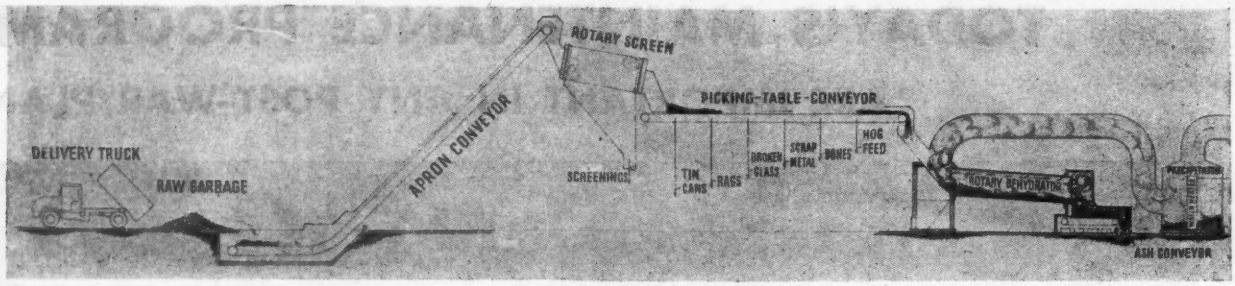
Summaries

In the 750 counties reporting, the average mileage of county roads was 690, with seven states averaging over 1,000 miles per county, and nine less than 400 miles.

The right-of-way widths varied widely, but in most states the majority of the roads varied between 40 and 66. A few roads were as narrow as 14 ft.; thirteen were less than 25 ft.; eleven states had some rights-of-way 100 ft. or more, and six others over 66 ft.

The amount of guard rail required on county roads varies greatly with the nature of the country. In level country there is little necessity for guard rails except at bridges. In five states none of the counties reports any guard rail. In six states the mileage of guard rail averages one for each 1,000 miles or over of road; in twelve states the mileage of road per mile of guard rail lies between 100 and 500; in nine states it is less than 100. Pennsylvania reports a mile for each 4 miles of road.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 53-57*



General scheme of handling, picking, and incinerating refuse at plant of Oakland Scavenger Co.

Waste Disposal With Several Unusual Features

A cooperative company collects and incinerates 270 tons of refuse from four communities, about a third of which is picked out and sold.

THE garbage and refuse of the municipalities of Oakland, Emeryville, Piedmont and Hayward, California, are collected and disposed of by a corporation unusual in such business—the Oakland Scavenger Co.; unusual in that it is owned by the 250 men who actually operate it. (Because some of these men have been drafted into war service, it has been necessary to add 50 "outsiders" to the force.) The men run the business and pay themselves dividends when the profits warrant it. The plant has been operating for five years and now it comprises modern, efficient mechanical handling and incinerating equipment.

The company's 86 trucks collect about 270 tons a day from an area whose farthest point is about 16 miles from the plant. The trucks are of 10 cu. yd. capacity, carrying loads of 3½ to 5 tons. The bodies are about 3 inches wider at the rear than the front to facilitate dumping.

The refuse is dumped at the plant onto a concrete floor, then pushed by a bulldozer into a pit, at the bottom of which is a pan conveyor, which carries it up an incline to a height of 50 ft., where it is discharged into a rotary screen, where the dirt and fine material are screened out. From the screen it is discharged onto a picking table conveyor, where tin cans, rags, bottles, broken glass, metals, bones, rubber and hog feed are removed by pickers. The remaining rubbish, about two-thirds of that collected, is discharged through a chute into a rotary kiln-type dehydrator or dryer, from which it is discharged into an oil-fired combustion chamber, where it is burned. The gases of combustion are drawn by a fan into a precipitator, where they are cooled and chemicals added to destroy the odors.

This plant burns from 7 to 11 tons of refuse per hour. Another incinerator plant is under construction capable of drying and burning up to 20 tons an hour. The new dehydrator, instead of employing a rotary kiln, uses three chain-grate stokers at successively lower elevations, which move the refuse successively from each to the next lower, the whole being 80 ft. long.

Details of the Plant

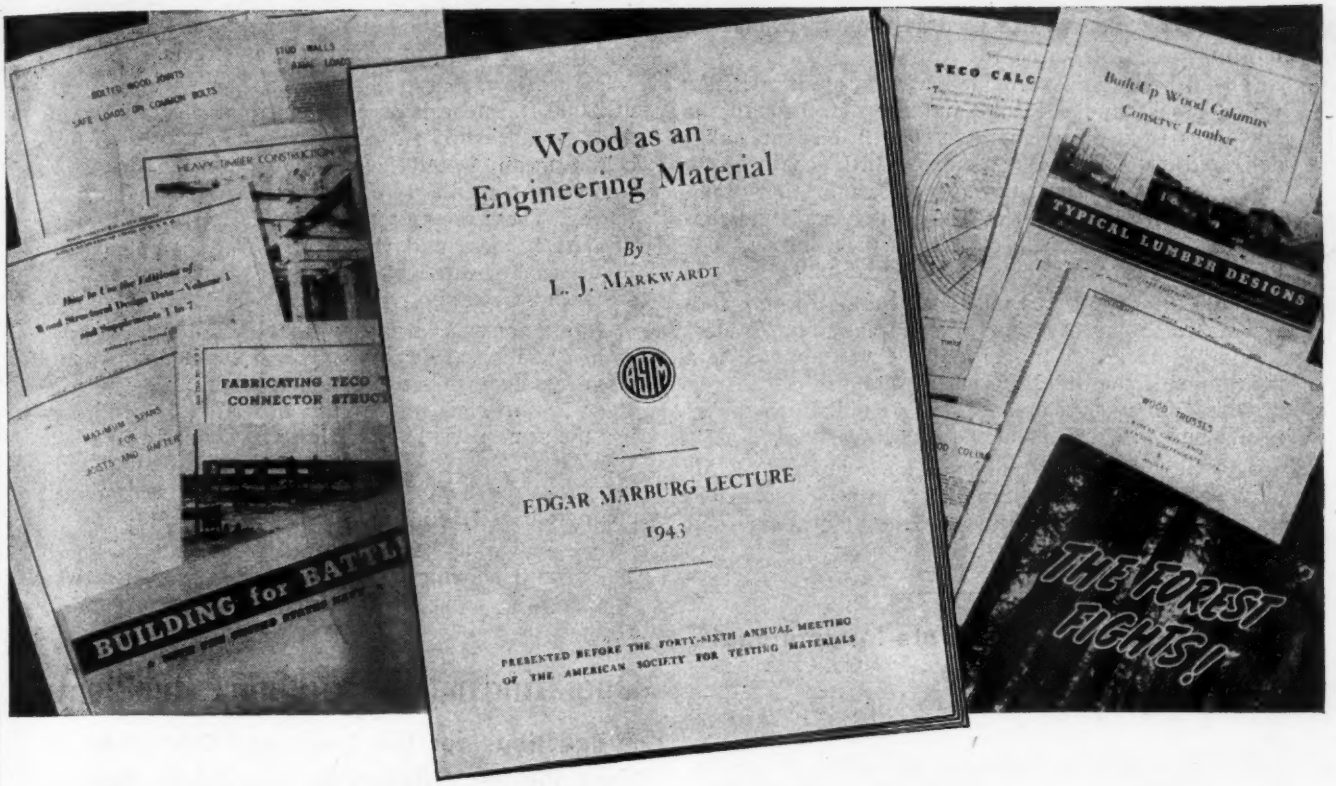
The conveyor consists of a 48″ wide overlapping steel apron with retaining sides 6″ high, mounted on two strands of strap-link roller chain riding on T rail tracks in the up run and on angle iron tracks in the return run. The inclined portion of the conveyor is 106 ft. long, set at an angle of 32° with the horizontal. A hand-operated gate controls the rate at which the refuse is withdrawn from the pit. The conveyor is operated by an electric motor through a Link-Belt P.I.V. gear variable speed transmission, herringbone-gear speed reducer, and a roller chain drive, which, by electric remote control, can operate the conveyor at any speed between 8 and 24 fpm. A backstop of the automatic band brake type automatically arrests backward motion of the conveyor in case of interruption of power, operating the moment there is reverse motion of the operator head shaft.

The screen is a large-diameter rotary with 1½″ perforations, set at a slight incline and revolved on four large-diameter rollers at 6 rpm by an electric motor. The screenings drop into a bin and are used as fill on the property—a 460-acre swamp. It originally was thought that strings and rags might catch in the perforations and occasionally have to be burned off, but no need for this has arisen.

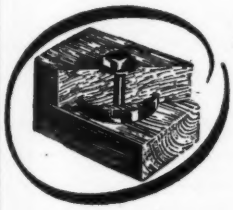
The picking table conveyor is a belt 60″ wide which is supported on closely spaced Link-Belt idlers which have a long horizontal central roll and short inclined end rolls, thus forming a shallow trough 70 ft. long. The belt passes around a pulley at each end, one of which has take-up bearings for adjusting the belt tension. The belt is operated by a motor through variable-speed transmission, and can be regulated between speeds of 22 and 66 fpm. A scraper-type cleaner with a rubber-blade cleaning edge, located below the pulley at the discharge end, cleans the belt as it starts on the return run.

Nine pickers, standing along both sides of the belt, remove the usable and non-combustible materials. The cans are dropped into a large bin, from which they are removed, weighed and hauled to a railroad gondola car and shipped to purchasers; about a carload daily being shipped. Other materials are dropped by the pickers into large barrels. About 30% of the total volume of the refuse is removed by the pickers.

About half of the glass removed, 10 to 20 tons a day, is in the form of good bottles and jugs, which are sold for re-use. The other glass is broken up and



BASIC TIMBER ENGINEERING DATA FOR ARCHITECTS AND ENGINEERS



"WOOD as an Engineering Material," by L. J. Markwardt, distinguished research authority of the U. S. Forest Products Laboratory, was presented at the invitation of the American Society for Testing Materials as the 1943 Edgar Marburg Lecture.

The purpose of this annual lecture is to present outstanding developments in the extension of knowledge of engineering materials.

In continuation of Teco's practice of making latest information on timber available to engineers and architects, copies of this lecture have been obtained and are available on request.

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sold to glass plants to be used as "cullet" in making new glass.

The dehydrator is provided with angle-iron lifters which break up the refuse and drop it through the hot gases from the incinerator. The dried material is delivered to a 5 x 20-ft. forced-draft chain grate stoker, which carries it through the combustion chamber, where it is incinerated. The average moisture content of the refuse fed to the kiln is 65%, but exceeds this in the fresh fruit and vegetable season.

The ashes drop to a Link-Belt "Promal" chain conveyor, which moves them at 10 fpm along a steel trough in a concrete tunnel and up a 30° incline to a point outside the building, where they are discharged directly into a truck or onto the ground. Each ton of refuse burned gives about 9 cu. ft. of ashes.

Thomas Ferro is president of the company. M. M. Manov is the consulting engineer, who is responsible for most of the novel features of the plant, developed in collaboration with Link-Belt engineers.

The Proposed Golden Gate International Airport

(Continued from page 18)

The estimated cost, including rock sea wall, dredging and filling, erection of buildings, lighting and drainage of runways, and construction of a seaplane base, is $20,000,000, divided as follows:

Rock wall	$ 840,000
Fill, including stripping	9,640,000
Storm and sanitary sewers	2,720,000
Paving of runways	3,000,000
Lighting	300,000
Buildings	1,000,000
Seaplane base	500,000
	$18,000,000
Engineering and contingencies	2,000,000
TOTAL	$20,000,000

In estimating cost, information was available from a final report on the construction of Treasure Island, which was similarly made by dredging and filling a wall-enclosed area. Also information concerning the construction of the U. S. Naval Air Station at Alameda was made use of. In making the fill of Treasure Island, 36,000,000 cu. yd. of earth were required. In Alameda, 22,500,000 cu. yd. were moved at an average cost of a little over 9 cts. per cubic yard.

In designing the airport and preparing plans for submission to Washington, it was necessary to obtain information on a wide variety of subjects. Among these were tidal currents in the bay; titles to the land involved: Federal bulkhead lines; the effect of dredging for fill on the tidal prism, and so locating it as not to prevent dredging of deep channels for shipping terminals along the water front; and investigations relative to wind and fog and rain.

As to the wind and fog, these appeared to present no obstacles.

The land upon which the airport is to be located lies partly in Berkeley and partly in Albany and may be leased from these cities. The Santa Fe Railway Co. owns all of the waterfront except a small portion owned by the Pacific Guano Co. and the Paraffine Co. and the shore ends of four Berkeley streets.

To obtain the desired soil data, borings were made at 2,000 ft. intervals over the entire area of about 3 by 4 miles, carried 35 ft. below low water, which is 3.6 ft. below mean water level. The table on page 18 shows the percentages of sand and clay found in each boring. These are seen to vary widely, from 0 to 60% of sand in clay, and from 0 to 22% of sand in mud in the area covered by the airport, and 0 to 44% in the area surrounding it.

Population statistics show that Berkeley has grown from 13,214 in 1900 to 85,547 in 1940, and Albany from less than 800 to 11,493. Oakland, also in Alameda County, has grown from 66,960 to 302,163 during the same period; and Alameda County as a whole from about 100,000 to 469,183. The five counties in the bay area had, by the 1940 census, a combined population of 1,183,885.

The above has been prepared from data furnished by Harry Goodridge, city engineer of Berkeley, who prepared the plans for the airport.

Operating Imhoff-Trickling Filter Plants

Suggestions for the Care and Operation of Such Plants, Offered by the South Dakota State Board of Health

ONE does not read much about Imhoff tanks in recent years, so much attention is being paid to newer ideas in sewage treatment. But these tanks are still being used in a large percentage of the smaller municipal plants throughout the country—certainly more than half of them, and in many of the larger plants. For example, of 74 municipal plants in South Dakota, 60 contain Imhoff tanks. Of 213 plants of all sizes in Ohio, Imhoff tanks are found in 112. Where secondary treatment is necessary in the small municipalities, the trickling filter is quite generally used.

Because of this common use of these two types of small plants, and the fact that the operators of such plants have not, in most cases, had much experience, the South Dakota State Board of Health has published suggestions for the care and operation of such plants. Believing that they will be valuable for operators in all states, to serve as a check list even if the ideas themselves are not new to them, we reproduce the suggestions herewith.

Imhoff Tanks

A. Sedimentation or Flowing-Through Compartment

1. Grease, scum and floating material should be removed daily. This may be done by means of a skimming device consisting of a multiple-tined fork covered with ¼ inch mesh screen. Grease, match sticks and floating garbage should be removed from the tank and buried or burned. This type of material should *not* be placed in the gas vents.

2. Clean the sides and sloping walls with a squeegee or other suitable device at least once a week. The material should be pushed down through the slot and into the sludge compartment.

3. Clean the slot at least once a week by means of a chain drag or similar device.

4. Keep inlet and outlet compartments clean.

5. Use a minimum of turbulence whenever performing any of the cleaning operations so that the settling efficiency will not be decreased.

B. Gas Vents and Scum Compartment

1. Break up the scum at least once a week by any one of the following methods:

(a) Use hoe, rake, or similar device.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 53-57*

(b) Use a fine water spray, being careful to apply a mimiimum amount of water so no excessive static head will be created which might cause sludge to flow from the sludge compartment into the settling chamber.

(c) Use a pump with the suction taken from the clearer water level in the gas vent itself.

2. Keep scum broken up in winter time by punching holes through ice to permit the escape of gas.

3. If scum accumulates too rapidly and will not settle, remove some of it to the sand bed for dewatering and drying.

C. Sludge Compartment

1. Draw sludge before the level reaches within 18 inches of the slot at the bottom of the settling chamber.

2. Sample sludge at least once a month to determine sludge level. The depth of sludge may be determined by means of a sludge sounder, a hand pump with suction hose, or a depth sampler of suitable design.

3. Draw sludge in small amounts at frequent intervals. Do not open the valve too rapidly or too far.

4. During the summer months sludge should be drawn at least once a month.

5. Draw off sludge in the winter if the level in the sludge compartment comes within 18 inches of the slot.

6. Do not withdraw all of the digested sludge as some is required to serve as a seeding material and to act as a buffer for the incoming fresh sludge.

7. If sludge does not flow readily when the valve is open, flow may be started by agitating the sludge around the sludge inlet with long rods through the sludge riser pipe or by applying water under pressure at the inlet end of the pipe.

D. "Foaming" in Imhoff Tank

"Foaming" is a term used to describe the condition which sometimes develops in Imhoff tanks, whereby gas, froth and scum rise in the scum compartment. Besides being unsightly and disagreeable, this foaming seriously interferes with the efficiency of the plant. Dark scum and solid matter may be carried over into the settling compartment from which it can flow out of the tank with the effluent and so cause a reduced settling efficiency. This unsatisfactory effluent places an increased load on subsequent treatment units or the receiving stream. When foaming does occur, the following simple treatments, under certain conditions, may be used to remedy or improve the condition:

1. Try drawing off some of the sludge.

2. Hosing the gas vent area with water under pressure will sometimes help.

3. Cut the tank out of service for awhile so that fresh solids will not be added and allow the tank to rest.

4. Paddling the foam with long-handled hoes is also temporarily effective.

5. Hydrated lime added through the gas vents at daily intervals sometimes overcomes "foaming" conditions.

6. Treatment of raw sewage with 20 to 50 pounds of chlorine per million gallons of sewage (2.5 to 6.0 ppm.) may help lessen foaming.

In some cases, it is even necessary to completely drain the sludge compartment of sludge and to start the operation over again by "seeding" or adding some digested sludge from a properly operating Imhoff tank, if such sludge can be obtained. In order to properly "seed" fresh sludge, the daily amount of fresh solids entering the tank should equal not more than 2 or 3% of the "ripe" sludge present, on a basis of weight of dry solids. That is, if 10 pounds of fresh solids are added daily, the amount of seed required will be 500 pounds of ripe sludge, or if 100 gallons of fresh sludge are added daily, about 1000 gallons of ripe sludge will be required.

Recirculation by pumping of foam and liquor in the gas vents has also been used in some instances to abate foaming.

Trickling Filters

1. Inspect nozzles daily. Clean them and replace broken ones.

2. Keep filter surface free of weeds and wind-borne debris.

3. Remedy or prevent "ponding" or "pooling" of the filter bed. This can best be done by:

(a) Flushing surface of filter with fire hose.

(b) Raking or forking the surface.

(c) Punching holes through top layer with iron bar or other suitable tool.

(d) Using heavy applications of chlorine to the filter influent.

(e) Cutting out of service for 12 to 48 hours.

4. Flush out distribution system periodically.

5. The underdrains may also need flushing occasionally by means of water under pressure.

6. Control odors by chlorination of influent (5 to 8 ppm). The biological action of the filter is not disturbed by small chlorine residuals.

7. Control filter flies (psychoda) by periodic flooding of the filter bed for about 24 hours, once every week or 10 days. Heavy doses of chlorine may also inhibit the development of filter flies.

8. Inspect mercury seal on rotary distributors periodically.

Final Settling Tank (Humus Tank)

1. Keep inlet and outlet structures free of extraneous accumulations.

2. Pump sludge frequently to prevent gasification.

(a) For plants having Imhoff tanks, return the sludge to the influent line rather than directly to the gas vents.

(b) Recirculate from the hopper of the final tank during periods of low flows to completely clean out the sludge.

3. Use baffles to keep surface scum out of effluent.

Speakers at A.R.B.A. Annual Meeting

Paul G. Hoffman, President of the Studebaker Corporation and Chairman of the Committee for Economic Development, will be a headline speaker at the Conference to be held in the Edgewater Beach Hotel, Chicago, February 1, 2 and 3. Although the program has not yet been completed, several other nationally known speakers have been scheduled and acceptances are expected.

Other speakers include: Colonel William N. Carey, chief engineer of the Federal Works Agency; Samuel C. Hadden, chairman of the Indiana Highway Commission; Hon. Carter Manasco, chairman of the House sub-committee on distribution of war surpluses; R. G. LeTourneau, president of the LeTourneau Company; Hon. Jesse P. Wolcott, member of the House Roads Committee and of the Banking and Currency Committee; Hon. J. W. Robinson, chairman, House Roads Committee; H. E. Hilts, Deputy Commissioner, Public Roads Administration; James J. Skelly, president, Highway Contractors' Division; Arthur F. Ranney, county engineer, Summit County, Ohio; R. W. Gamble, president, Municipal Division, and W. Vance Baise, State Highway Engineer, North Carolina.

One of the highlights of the Conference will be the panel discussion of whether there will be dumping of surpluses of construction machinery by the Army and Navy. Representatives of the U. S. Treasury, the War Production Board, of Congress, and of the highway industry will participate. After the panel discussion, a question and answer period will be held.

Because of rationing restrictions, those who plan to attend the Conference are urged to make their reservations immediately for the President's Dinner, to be held in the Marine dining room Wednesday, February 2. The Old Timers' Reunion will be held Tuesday, February 1. The buffet dinner will be followed by first class entertainment.

Reaction of Flexible Pavements Under Bearing Tests

According to the Asphalt Institute, field load bearing tests have not so far proved generally satisfactory as a measure of the bearing power of flexible surfacings subjected to heavy aircraft wheel loads. It is possible to make a truer estimate of the bearing power of a given design, and the relative bearing power of different designs, by isolating the factor of initial settlement under concentrated loading. Initial settlement is influenced by the degree of compaction of the soil mass, and any additional settlement produced by a second load application is usually much less. The third and subsequent repetitions produce regularly decreasing settlements, so that cumulative settlement for any number of load repetitions can be estimated on a basis of four repetitions. Deflection occurs in a similar way.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 53-57*

The tests indicated that it may be misleading to select a single deflection value as "critical," if the factor of initial settlement is not isolated. With these considerations in view, a procedure is outlined for making field load bearing tests in which the following points are included:—(1) The smallest load that can be accurately recorded should first be applied and maintained until no further deflection occurs. Strain dials should then be set at zero, and all load increments released back to this initial load. (2) Each load increment should be applied and released four times, and cumulative deflection and settlement should be plotted for the design load repetition. (3) While it is preferable to use a testing head of area equal to the tire contact area, a head with 30-in. diameter will probably be sufficient, provided that loads are estimated in lb./sq.in. When this is not possible, or when different tire contact areas must be considered, not less than three smaller testing heads should be used in extrapolating values. (4) In testing subgrade soils, a surcharge should be added to prevent side displacement at the surface.

Experiences With Victory Alum

Waterworks Operators of Several Cities Find No Difficulty in Using It. Some Prefer It to Prewar

THE War Production Board last year issued conservation order M-1-h, providing that after Sept. 1, 1942, it would be illegal to use bauxite containing less than 15% silica for chemical manufacture. To make filter alum that would meet the AWWA specifications, using the high-silica ores permitted, would greatly increase its cost and decrease plant output by up to 50%.

To meet this condition the AWWA revised its filter alum specifications, lowering the minimum water-soluble alumina requirement from 17% to 14%, increasing the iron limit from 0.75% to 3.0% and that of the water-insoluble from 0.5% to 15%. Alum furnished under these specifications has been known as "Victory alum." The specifications have proven to be unnecessarily liberal, for ten analyses of Victory alum furnished by five manufacturers showed 15.6% alumina, ranging from 14.9 to 16.2; iron averaged 0.37%, only two samples being over the 0.75% of the prewar specification; and the insoluble averaged 6.09%, with a maximum of 8.99. This certainly is to the credit of the manufacturers.

Moreover, comparatively little difficulty has been experienced in actual use of the new alum. Based on the soluble alumina content it might be expected that $\frac{17}{14}$, or 121%, as much of the new alum would be required in a given case; but on the basis of the actual alum as furnished this is reduced to $\frac{14}{15.6}$, or 111%; and some plants find no increase necessary.

A symposium of experiences of Pennsylvania waterworks operators with Victory alum was held this summer by the Pennsylvania Water Works Operators Association, from which the following items have been abstracted.

Northampton found little difference between the amounts of the two alums used. The increased insoluble material presents no problem except the necessity of more frequent flushing of the sludge from the tanks; in fact, it seemed probable that it contributed some advantages. In the past Mr. De Groot, Manager of the Northampton Water Division, had found difficulty in obtaining good floc in extremely cold weather, the floc being pin-point and passing through the filters and even into the distribution system. But in last winter's coldest weather, with Victory alum in use, there was no such trouble, and it seemed probable that the insoluble material served as nuclei and assisted in floc formation. The same effect of the insolubles was noticed at Easton and at Phoenixville also.

The insolubles are very fine but are entirely removed by filtration in Easton, reducing the length of filter run by 30%. Reading provided controlled air agitation in the dissolving, solution and feeder tanks, and there has been no objectionable deposition of sludge in any of the tanks after months of continuous operation. Kennett Square finds it necessary to keep the stirring paddles in the solution tanks in operation continuously to prevent the settling of the inert material in the tanks; also it is necessary to flush the orifice boxes frequently because the insolubles settle in them.

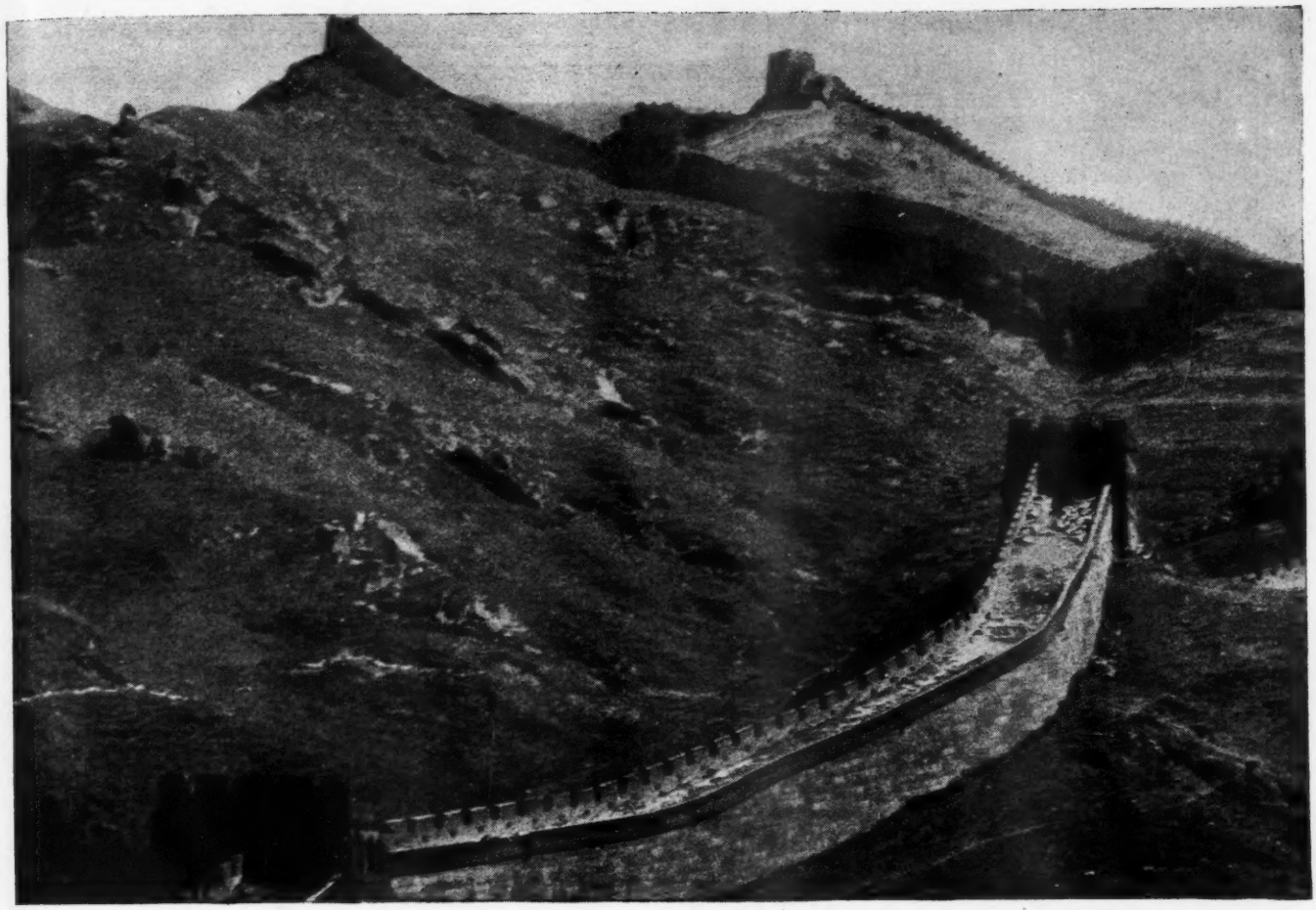
As to amount of alum required, Reading finds no increase necessary for proper coagulation, possibly "due to the acid nature of the insoluble material." Kennett Square found the same results as formerly obtained with 10% *less* alum, while "with equal doses the time for floc formation with Victory alum is somewhat shorter." Phoenixville finds the results from Victory alum "uniformly better than those previously obtained from the use of ground 17% Al_2O_3 aluminum sulphate (grade XXA). There has been a constant reduction in alum dosage varying from 11% to 37%, having no apparent relationship to any quality of the water except possibly its turbidity. . . . Before the use of Victory alum was started a pre-lime or soda ash application was required for raw water alkalinity of less than 34 when the turbidity was in excess of 800 ppm. This is not necessary with Victory alum."

Commenting on these reports, L. L. Hedgepeth suggested that the absence of necessity for increased dosage of alum in the western part of the state may be due to the waters there being more mineralized. "This is believed to be due" said he "to the frequently observed phenomena of flocculation, wherein in well buffered waters floc formation is a function of the alumina dose and in soft or poorly buffered waters flocculation is largely a matter of depressing the pH to the optimum point or zone of coagulation. . . . Victory alum, having equal or greater acidity, will coagulate with equivalent or even lower dosage in soft waters."

Waterworks Maintenance and WPB Regulation Headaches

Probably many other waterworks superintendents will agree with the following, which was written to us by a superintendent in a New England city:

"I think one of our greatest headaches today is the complicated output of Federal regulations which only a first-class lawyer could interpret. I can't understand, with all the help they have, why they can't delegate someone to write a statement in connection with each one, setting forth in ordinary clear and intelligent language what they are all about. I confess I haven't time to sit down and try to dope them out and I am sure I wouldn't have much confidence in the result if



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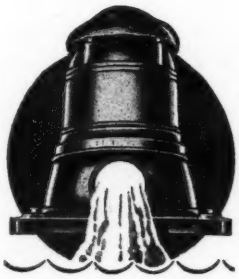

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I did. Evidently the government is now getting concerned that water works officials are not ordering replacement stock as much as ordinary maintenance normally demands; and if that be so, I am inclined to believe it is due to the fear a fellow may run afoul of the law, as small departments in particular haven't the help to comply with the strict letter of the law in connection with their stock inventories. It is not a healthy situation and I hope to see it ease up before long, because I can't help feel that the Army and Navy have gone crazy in grabbing up materials long in advance of their needs, which proper long-range planning would have made unnecessary, and would have given us an opportunity to maintain our plants on more nearly an even keel.

"The mistake, I believe, has been too many men in governmental positions lacking in practical experience with industrial problems (too many lawyers for one thing). I believe if water works officials had been put on their merit, better results would have been obtained in the long run, because I am firmly convinced that, by and large, there is no more conscientious group of men in any profession. Well, this is an old chestnut now, but I think it representative of the view of many water works men."

Serious Result of Lack of Records and Equipment

On January 4th the State Department of Health of Washington was informed that Tekoa, a city of about 1,500 population, was entirely without water, its wells having gone dry. In less than 6 hrs. the Department had obtained additional information, made pump tests and draw-down readings on the wells, chlorinated a tank truck of water for house-to-house delivery, and installed a chlorinator at a well of the Union Pacific R. R. which was operating but contaminated.

The investigation by the State Department's engineers revealed the following conditions. The town is divided in two by Latah creek. The supply is derived from two wells about 15 ft. from the creek, by means of deep-well turbine pumps that pump directly into the distribution system, and from this to a reservoir on the same side of the creek. Water reaches the part of the town across the creek through one line of 10" cast-iron b & s pipe laid on the creek bottom, with no special support or protection.

At 9 a.m. on Jan. 4 the gauge in the pump house had fallen from the usual 135 ft. to 100 ft. By 12:30 there was no water in the distribution system. A reserve pump was put into service—still no water. Then the water in one well was found to be so low that it was thought the pump was breaking suction, and that the well had gone dry. Neither pump had a master meter on its suction; had there been, it would have been apparent that there was plenty of water being pumped somewhere. The pipe crossing the creek was valved at one end only—that nearer the pumps; and when this was closed, pressure began to build up, indicating a leak in the crossing. Investigation showed that this pipe had opened at a joint 40 ft. from the wells, discharging toward the bottom of the turbid creek, so that the leak escaped detection.

One side of the creek was now O.K., but that part of the city on the other side had no water, and it was decided to connect hydrants on opposite sides of the creek by 300 ft. of fire hose. To effect this and prevent water returning to the creek through the unvalved end of the crossing necessitated closing two valves—and it was six hours before the valves could be located and closed. There was no record of their location, and a blacktop pavement had been laid over them a few years ago.

The problem could have been solved and the remedy applied if there had been adequate records and equipment. What these were is described as follows by Emil C. Jensen, district public health engineer of the State Dept. of Health, in "Water Supply and Sewerage News," the bulletin issued by that department.

(1) Air lines should be provided on deep wells for taking water level measurements, and an accurate and continuous record kept of the water levels at all times. Had there been an air line on the small well in this case, the excessive drawdown would have been noted early in the day.

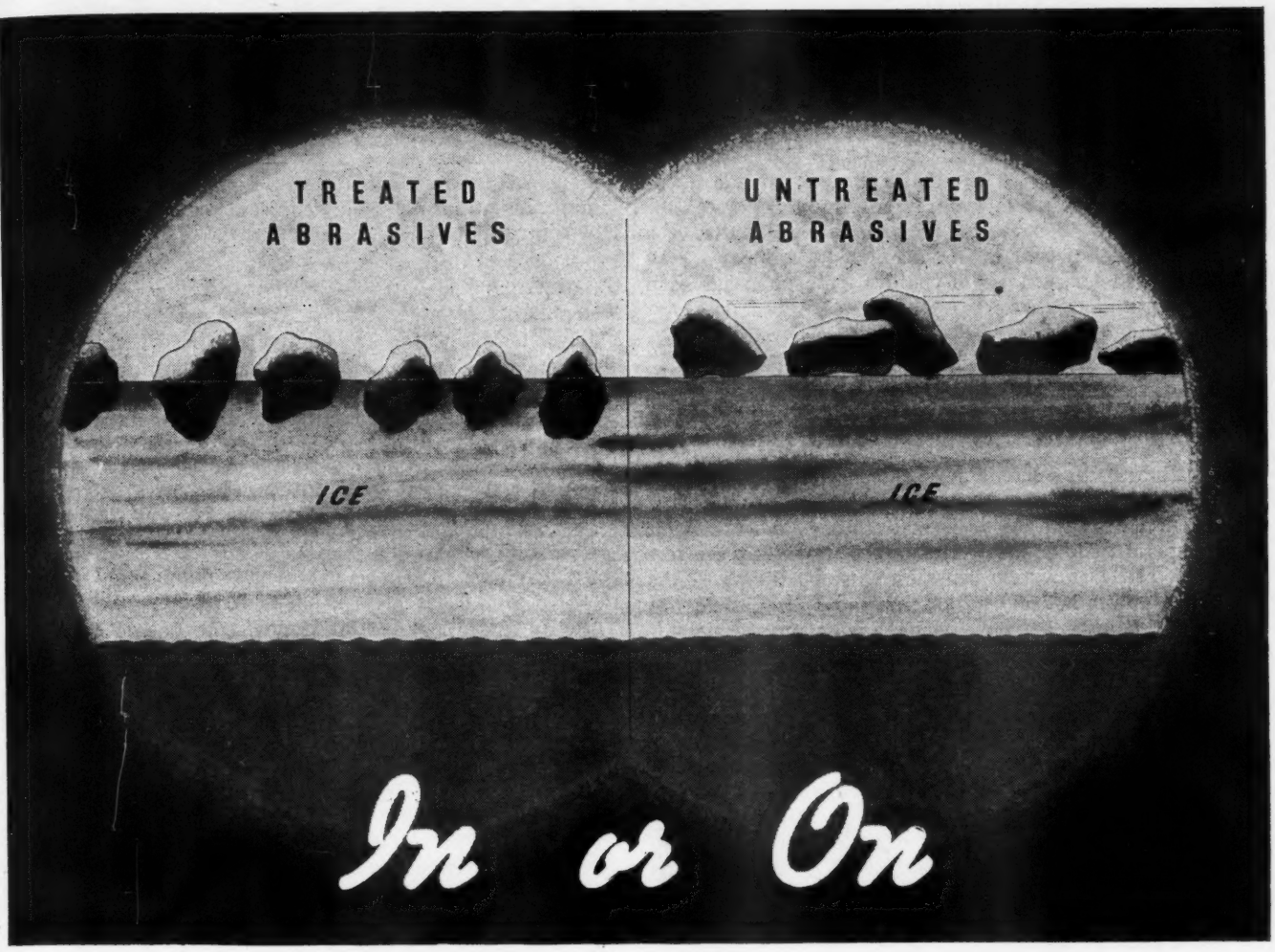
(2) Master meters should be provided on all supplies, whether it be pumped from a well or lake, or gravity supply from a stream or spring. Had there been master meters on the pump discharges in this case, it would have been very simple to detect the excessive pumping rate that was taking place due to the reduced head.

(3) All valves should be accurately located with respect to fixed points, such as hydrants, curbs, or telephone poles; charts, maps, or records should be prepared listing these locations. Also, valve boxes should be provided and brought up to street grade.

Graded Stone Bases for Runways

In building runways on two aerodromes located on sand dunes and flat areas of sandy loam, British engineers used a graded stone base because (a) the existing sand, very fine and cohesionless, could not be readily stabilized, and (b) there were good quarries near the sites. It was decided to place 4½ in. of graded stone in two layers on a stabilized sub-base, add a sealing-coat and finish with a thin bituminous carpet. The method of construction was as follows:— The topsoil was removed to an average depth of 7 in. and stacked to provide soil for seeding. The ground was levéled by machinery for the formation of the runways, and sand dunes were removed and depressions filled in. On Site 2 the drainage system was then completed (lack of drainage on Site 1 caused trouble during stabilizing operations). Quarry waste, ranging from 5 in. to 2 in. in size, with about 20 per cent of clay overburden, was spread by hand at an average yardage of 7.5 yd./cu.yd. and rolled with 8- or 10-ton rollers. The lower coat of graded stone consisted of 1½-in. to ¼-in. stone dumped at the rate of 13.4 sq.yd./ton, and spread roughly by an 8 ft. grader blade; granite or limestone fines were then spread at the rate of 29 sq.yd./ton, mixed in with chain or spike-tooth harrows, watered, mixed again and rolled. The layer was 2½ in. thick after final compaction. The top coat was laid in a similar manner, the stone being spread at the rate of 15.4 sq.yd./ton, and the fines at 42 sq.yd./ton. The sealing coat was of a tar-asphalt mixture, spread at ¼ gal./sq.yd. at 180° to 200°F. For the wearing course, ¾-in. granite chippings were spread, sprayed with asphalt emulsion, covered with ⅜-in. chippings and rolled. After a day asphalt emulsion was sprayed again, dusted with stone dust and rolled.

The runways were designed for use by light aircraft, but Site 1 has been subjected to heavy loads and has shown no sign of failure through two winters. If used by very heavy bombers, the thickness of the



The Measure of "Grip" on Icy Roads

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graded stone layers should be increased to 6 in. and the wearing course to 1½ in. Although the perimeter track in this case was given a thinner surfacing than the runways, this is not recommended. Graded stone bases may be constructed equally well on clay subgrades, but in this case the sub-base should be prepared by mixing in sand and gravel, by means of sheepsfoot rollers, to reduce the clay fraction of the top 6 in. to 30 per cent. In very fine-grained clay a greater depth should be stabilized. A heavy clay field, used for parking mechanical transport, has been successfully treated.

The Electron Tube

(Continued from page 22)

controlling the current after the flow has once begun. In other words, a negative grid will prevent the flow of current as the anode is made positive; but once it has permitted the electron arc to start, it is powerless to stop it. The current can then be stopped only as the anode power is removed, or, in an a-c circuit, during the a-c voltage negative cycle. Even then, the deionization time required to regain control may be approximately a millisecond; therefore, thyratrons do not operate at frequencies much greater than the commercial power frequencies.

The thyratron is the handy-man of the industrial tubes. It controls motors, energizes magnetic contactors, and supplies small amounts of heat whenever accurate control or high-speed operations are required. Operating indirectly, by controlling generator fields or saturable reactors, it can control large amounts of power—many hundred horsepower or many kilowatts —for heat or lighting.

The *ignitron* tube is similar to the thyratron in that it is a gas-filled tube, but it differs in that its cathode is not heated to free the electrons. Instead, its cathode is a pool of mercury and its electron-emitting energy is derived from the arc stream itself. This is a cumulative action—the larger the current the more electrons are made available. Thus, the instantaneous current capacity of the ignitron is limited only by the size of the elements and the leads to carry the heavy current. This may be thousands of amperes. The continuous current rating is determined by the ability of the tube to dissipate the heat losses. The larger sizes of ignitrons have built-in water jackets through which cooling water is circulated.

Since the ignitron, unlike the thyratron, does not have electrons immediately available at a hot cathode, its control element, the "igniter" (a pointed piece of crystal dipping into the mercury pool) must actually "blast" a few electrons loose from the mercury to start the arc stream. This requires real power; as much as 40 amperes at 200 volts, for a few microseconds. So it can be seen why the ignitron is most practical for high currents and large power requirements.

Ignitrons are the heavy artillery of the industrial tubes. They are called upon to control the thousands of amperes required for resistance welding. They rectify and control the large amounts of power needed for the manufacture of aluminum, in electrochemical processes, and for steel mill and factory direct-current shop voltages.

To SUM UP BRIEFLY: The phototube, using the energy of light to release electrons from its cathode, has so small an output in microamperes that a pliotron or thyratron must be used to amplify it to a useful value. The output of the pliotron (milliamperes) is sufficient to operate small relays, or to control a thyratron. Thyratrons, in turn, control amperes to operate large contactors, or motors in the usual control sizes from fractional horsepower up to 5 horsepower or more, or to control ignitrons. Ignitrons can handle hundreds of amperes, but require a reasonable amount of control power for operation.

Take any kind of rectifier—copper-oxide or selenium —anything that will pass current in one direction and stop it in the other. Connect a rheostat in series and drive it by a voltmeter element, the positive terminal of which is connected to the negative terminal of the rheostat. Gear the rheostat to the voltmeter element in such a way that more negative voltage will cut in more resistance (see Fig. 1). The rheostat is stepless, and goes to infinite resistance or open circuit at the high end. It is assumed that the voltmeter and rheostat can move extremely fast, 1,000,000 times per second; and the voltmeter is of extremely high resistance, perhaps a megohm or more.

This simple circuit can be used to replace a triode pliotron in any industrial circuit, and will do exactly the same job. If the tube is a tetrode or pentode, other series rheostat-voltmeter combinations may replace each grid.

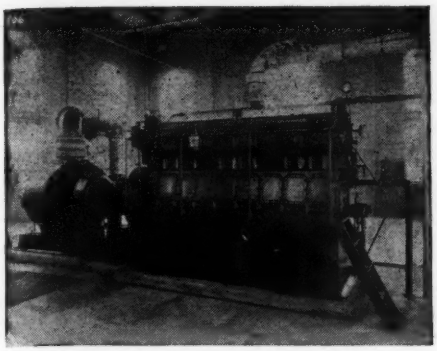
Would you like a phototube? Then simply replace the voltmeter with an exposure meter so that increased light on the sensitive surface will move the meter element to cut resistance out of the rheostat (see Fig. 2).

As for the thyratron and ignitron, they are no more complicated. In series with the rectifier we'll place a battery of about 15 volts and so connect it that it will be charged by the current which the rectifier permits to pass. (This corresponds to the constant arc drop of the thyratron for all current values.) Finally, in the circuit is a series relay that is connected to "seal-in" or "lock-in," when the circuit is completed through its own single, normally open contact. The relay armature is moved, and this contact is closed mechanically by the action of the control voltmeter (just as the rheostat turned, in the description of the pliotron). The contact moves to close as the voltage becomes less negative (see Fig. 3).

Once the contact has closed, however, the holding power of the series relay is so great that the small voltmeter torque is powerless to open it again until the current has stopped flowing.

The ignitron equivalent is about the same, except that we must remember that we are dealing with larger power, and the size of everything becomes larger. In place of the voltmeter, we can use a small solenoid. A rectifier in series with the solenoid, to permit current to flow in but one direction, may not be necessary in our electromechanical picture, but it is necessary in the ignitron circuit to prevent injury to the igniter by reverse current, so we'll put it in to make our picture complete (see Fig. 4).

And that completes our one-lesson course on the industrial electron tube. We do admit that a few of the details (about as essential as trouser cuffs and pocket flaps) have been omitted. But the fundamental facts are here, and we would like to prove it in this way. If you ever run into a wiring diagram that features one of these mysterious electron tubes that has been worrying you, just paste a piece of paper neatly over the offending tube symbol and draw thereon the appropriate equivalent symbol. Then go right ahead and forget that electrons exist.



Gas engine direct connected to blower at Madison, Wis., sewage plant.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Effluent Used for Chlorinator

The Bowling Green, Ohio, treatment plant used water from the private water company that supplies the city for chlorinating the sewage, and during six years of operation paid for this water an average of $223 a year, the cost having reached $83.40 a month in summer, and as low as $1.10 a month. Wallace & Tiernan, being consulted, said that final tank effluent could be used for this except for the tray water supply. In 1942 final effluent was used for this purpose, a pump and pressure tank being installed to give a pressure of 40 to 60 lb. This cost about $300 to install and cut the water bill to $28.04 in 1942, although 1,000 lb. more chlorine was used that year than during any previous year. Primary tank effluent is used for the lawns at the plant, being flooded onto them by hose.[H1]

Recovery of Sewage Grease

Since 1903, when the Bradford, England, sewage plant went into operation, sales of wool grease and special commodities developed from it have produced a revenue of £2,084,182 (nearly $10,000,000). The amount recovered has been 207,504 tons. A research department has developed more and more specialized products from it until last year these consumed about 50% of the total yield.[D3]

Conserving Water At a Steel Plant

Kaiser's Fontana steel plant has no available supply of water except such as it purchases from a water company or obtains by pumping from deep wells on its own property. Therefore it reclaims, by treating it, all the water circulated for use in all cooling operations and in the blast furnace gas washers, pickle liquor and rinsing water, rolling-mill scale flushing and cooling water, domestic sewage, etc. No liquid wastes flow off the plant property. The supply is separated into domestic (including boiler feed) and industrial. Even with this re-use, about 2,200 gpm is required to replace loss by evaporation and otherwise, and 1,100 for domestic and boiler use. The total flow in circulation is approximately 58 mgd.

Incoming water is softened in two 50 ft. "hydrotreaters," recarbonated, and filtered, and pumped into a 750,000-gal. covered reservoir for the domestic supply, an overflow from which goes to the 1,250,000 gal. open industrial reservoir. Hardness is reduced to 70 ppm, and that for boiler feed to zero by zeolites.

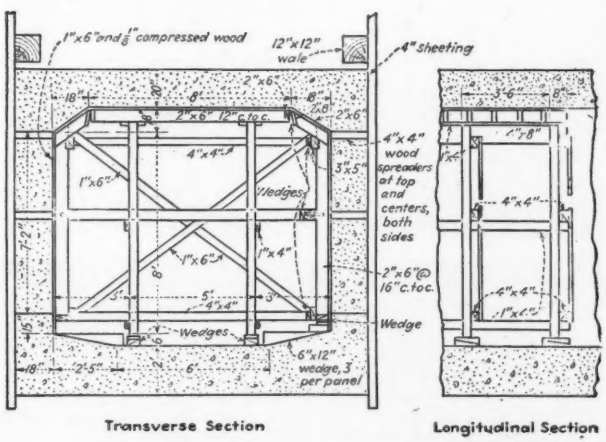
Blast-furnace gas-washing water has 80% to 95% of the suspended solids (coke dust, iron ore and lime) removed by sedimentation, 98% if ferric chloride is used as a coagulant. About 5,500 gpm is used for cooling rolls, picking up scale, dirt and oil; this is clarified by oil skimming and chemical sedimentation in a "clariflocculator." The effluent from these plants is pumped to a natural draft cooling tower. The sludge is dried on beds, the effluent from which flows into the sanitary sewer. It has been found that spent pickle liquor with enough lime to neutralize the excess acid makes a good floc with scale pit water; or chlorinated copperas can be made by mixing chlorine with the spent pickle liquor.

The domestic sewage is treated in a two-stage, recirculating biofiltration plant, and chlorine added in a contact basin with a helical baffle. The effluent is mixed with the water that serves the rolling mills. The sludge is dried on gravel beds.

Pickle liquor from the acid and rinsing vats, about 45,000 gpd, is discharged into a Douglas fir vat 30 ft. diameter by 10 ft. deep, and powdered limestone and ferrous sulfate added, precipitating calcium sulfate and ferrous hydroxide; air forced through the slurry oxidizing the latter to ferric hydroxide and ferric oxide. The effluent flows to the chlorine contact basin and combines with the domestic sewage effluent.[L1]

Building Pressure Sewer in Deep Trench

Hartford, Conn., is building 2333 ft. of reinforced concrete box sewer, partly 11 x 9½ ft., partly a double box with 7 x 9 ft. openings; to resist a pressure head of 30 ft.; in deep trench in clay soil. The bottom of the trench is covered with 3" to 6" of Class C concrete, on which the sewer is built. All trench is sheeted; most with 4" timber shoring, with 12" x 12" wales 8 ft. apart and 12" x 12" braces 10 ft. apart. In one dangerous spot 150 ft. long, steel sheet piling is driven before excavating. At another place 24 ft. deep, "subway shoring" is used, 10" x 10" H-piles on 8 ft. centers being driven before excavating and connected by 4" horizontal sheeting. Plywood could not be obtained for forms, so 1" yellow pine was used, covered with ⅛ in. oil-tempered compressed



Courtesy Engineering News-Record

Forms for the interior of the sewer at Hartford, Conn. were designed to permit removal of the side sections, which include the support for the sloping portion of the roof, before the central roof forms were removed. Sidewall and roof panels are carried forward by hand as the work advances.

wood. Side forms are left in place two days and top forms 7 days. The sewer is built in 40 ft. sections with copper water stops in the joints and ½ in. of cork filler covered with bituminous cement. Sixty to 65 men are employed one 10-hr. shift 7 days a week.[E2]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article; *article reviewed in the "Digest."

D *The Surveyor*
November 5
1. River Control, With Special Reference to Pollution Prevention. By John Hurley. Pp. 455-457.
2. *p.* Acid Neutralization Plant With Mechanical pH Control. By H. D. Thatcher. Pp. 463-464.
3. Recovery of Grease from Sewage. P. 466.*

E *Engineering News-Record*
December 2
1. *p.* Army Experience With Sanitary Fills. Pp. 91-92.
December 16
2. c. Box Sewer in Deep Trench Built for Flood Control at Hartford, Conn. Pp. 86-88.*

G *Water Works & Sewerage*
November
1. Laundry Waste Treatment by Flotation. By Rolf Eliassen and Henry B. Schulhoff. Pp. 418-421.*

H *Sewage Works Engineering*
December
1. Effluent Used for Chlorinator. By L. B. Barnes. Pp. 578-579.*
2. Plant Manual Explains pH in Theory and Practice. P. 579.
3. Equipment Maintenance in Time of War. Pp. 585-590.
4. Sewage Treatment Plants in U. S. A. Pp. 591-593.

J *American City*
December
1. Can Sewage Works Be Trusted? By I. Russell Riker. Pp. 43-44.

L *Civil Engineering*
December
1. Treatment Conserves Water at Steel Plant. By Arthur Taylor and Nelson Taylor. Pp. 579-582.*

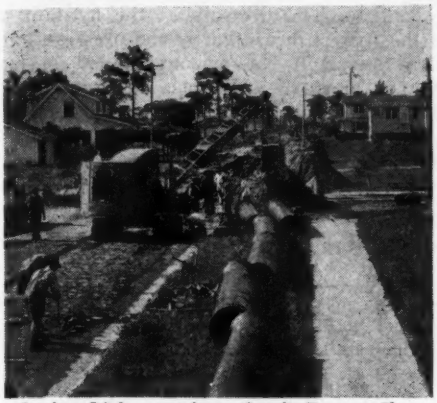
M *Water and Sewage*
November
1. *p.* Conservation and Sanitation. By Robert F. Legget. Pp. 34, 35, 48, 50, 52.
2. *p.* Standards for Municipal Sewage Treatment Plants. By Arthur S. Bedell. Pp. 36, 70, 76.
3. *p.* Sewage Treatment for Homes and Institutions. By A. E. Berry. Pp. 56, 58, 60.
4. *p.* Canadian Practice in Design of Storm Sewers. By David Jack. Pp. 60, 62, 64, 65, 67.

P *Public Works*
December
1. Operating Results of the Minneapolis-St. Paul Sewage Treatment Plant. Pp. 13-15, 32.
2. Recovery of Grease From Sewage. Pp. 21-22, 52.
3. Wartime Sewer Construction by Special Assessment. By E. N. Fletcher. P. 28.
4. *n.* Assessment for Sewer Extension and Treatment Plant. P. 52.

Newspaper Ballots on Postwar Projects

In planning postwar projects, the officials of at least two cities have enlisted the services of the local newspapers in obtaining the ideas of the citizens as to the order of preference for the several projects considered. In Miami the Sunday editions of two papers described 15 projects, with illustrations, and printed a ballot form on which readers were requested to number the projects in the order of their preference and mail the ballot to the city planning board. A newspaper in Houston, Tex., adopted the same plan.

In Miami the five projects highest on the list were: sewage disposal and sewer extensions; a new railroad terminal and related improvements; slum clearance and redevelopment; hospital improvements and additions; and waterworks supply source and extensions. In Houston the projects in order of preference were: street repairs; water supply; storm and sanitary sewers; better garbage collection methods; parks; and a health center.



Laying 24 in. cast iron pipe in Tampa, Fla.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Women Filter Plant Operators

Two plants under War Dept. control, one treating 4 mgd of surface water, the other 2.5 mgd of well water, are operated by women operators, who make all chemical tests, control treatment and handle all chemicals, except the connecting to feeders of chlorine and ammonia cylinders. On each shift there is a male operator directly responsible for the operation of the entire water supply system. Eleven women were selected from several hundred trained production workers and trained for three weeks, the first two in laboratory practice, the third in the hydraulics, care and operation of the plant. Later groups were first taught to clean the plant, then to operate the valves, handle chemicals, etc., and laboratory instruction was last. After a year of service "the arrangement has been highly satisfactory, the women being capable and willing workers within the limits of their physical ability and under considerate and intelligent supervision. In accuracy of operation and attention to details the results are better with women than with men; but men are more interested in the mechanical parts of the operations and more capable in handling them. . . . The most satisfactory water plant operation can be obtained through the use of mixed shifts."[A4]

Job Classification in Municipal Water Works

The foundation of any comprehensive personnel system is a sound classification plan, which consists of (1) grouping into classes these positions of approximately equal difficulty and responsibility, which call for the same qualifications and compensation; (2) writing specifications for each job in the department by giving descriptions of the position, the duties to be performed, and the qualifications required; (3) listing the class titles held by each employee. A sound salary and wage plan is very important. Titles should be standardized, not only in a given plant but for the entire country.[A5]

Contamination of Supplies From Limestone

Investigation of 130 farm supplies in the limestone region of Minnesota found most of them poorly constructed both above and below ground; 77% contained coliform organisms, 20% of them over 100 per 100 ml. Half of the farms with water-carriage toilet systems discharged sewage directly into the limestone formations. Liquid from several septic tanks was traced to nearby wells. There is real danger of underground contamination of municipal and private water supplies situated in the fissured and cavernous limestone area. Sewage has been traced to water supplies 2000 ft. away; in one case *Eb. typhosis* was isolated from a well water supply. Supplies obtained from springs in limestone formations should be considered as surface water supplies and provided with adequate treatment. Discharge of sewage into limestone formations should be eliminated.[A7]

Mechanical Pipe Joints

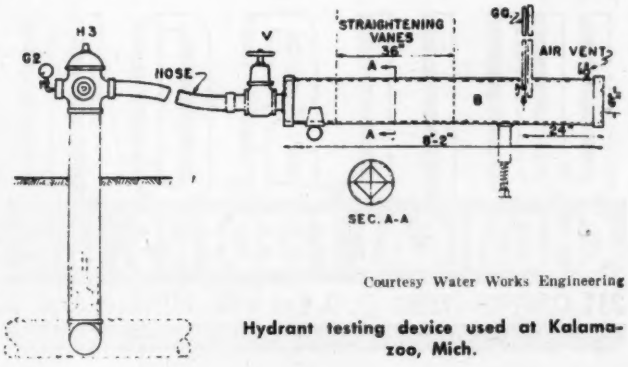
Standard sleeve-type couplings are suitable for pipeline working pressures up to 1500 psi; special couplings for higher pressures; the pressure rating being based on the strength of the middle ring. Gaskets for these couplings for water service are made of specially compounded rubber. They are put under a pressure in the coupling which must always exceed the water pressure in the main. Rubber has been used for this purpose since 1863, and the author has not heard of any reports of failure. Rubber gaskets have been found to be "live" and resilient after 28 yrs. of service. They are not subjected to sunlight, dry air, heat or tension, which are harmful to rubber.

Time studies of making these joints indicate the assembling time, from placing the first coupling part to final bolt tightening, using two men, to be 4 minutes for 4" pipe, up to 28 min. for 48" pipe. Curves can be laid by deflecting at the joints, allowable deflections varying from 6° for 2" or smaller and 4° for 3" to 24", down to 1° for 78"-84".

To resist excessive pull or thrust at a joint, it can be reinforced by 4 tie bolts set 90° apart around the pipe, 2 connecting the middle ring to lugs on one pipe and 2 to lugs on the other. On unanchored bends, a joint harness is used; this consisting of two bolts, each connecting 2 crowfoot lugs welded, one on each of the pipes, near the joint, the bolts being diametrically opposite.[A8]

Testing Hydrant Pressure Loss

A.W.W.A. hydrant specifications set a maximum allowable pressure loss through hydrant. To measure this in hydrants in service, Kalamazoo, Mich., uses a device described in the article and shown in the illustration. During the test both the valve in the hydrant and that in the hydrant branch are wide open, the flow being controlled by a valve in the appliance, which is mounted on a truck. The rate of flow can be measured by means of a pitot tube on a fire nozzle attached to this valve; the plan shown in the illustration, however, uses a standard orifice at the end of a large pipe. A vertical gauge glass GG is connected to the pipe 2' from the orifice, the head in this



Courtesy Water Works Engineering

Hydrant testing device used at Kalamazoo, Mich.

indicating the flow. The pressure at the hydrant before and during the flow is measured by the pressure gauge.[G2]

Using this device in Kalamazoo resulted in locating 9 defective hydrant valves, 17 stones in hydrants, 25 defective hydrant caps and 8 defective nozzles. Also it was found that 201 of the 4" hydrants gave a flow of 1,000 gpm or better.[F3]

Laying Mains in Deep Tidal Waters

To bring water to several islands near Portland, Me., 9,600 ft. of 12" w.i. pipe with welded joints was laid in water as much as 40 ft. deep, 2,000 ft. of it in a trench 12 to 15 ft. deep under a future navigable channel. Buoys spaced 65 to 70 ft. apart along the pipe being laid supported it in a curve of about 1500 ft. radius, which did not bring unsafe stress on pipe or joints; the buoy cables being lengthened as the pipe sank.

Another line of 8" and 12" c.i. pipe with a few flexible joints, 9,000 feet long, was laid in 60 ft. sections in water as deep as 120 ft., and the sections bolted together by divers. At another point 4,500 of 3½" steel pipe with welded joints and a "Victaulic" joint every 350 ft. was pulled into place by a 10-ton crawler tractor connected to it by a 5,000 ft. length of ¾" cable. Since the salt water here has been known to reach 28°F, provision was made for installing electric heaters to heat the water as it entered the submerged pipe.[E1]

Intake for Varying Water Levels

A 30 mgd water supply was to be drawn from a lake where the water level varied more than 150 ft. and 5 plans for an intake to provide for this were studied: 1—mounting the pumps on an incline down which they could travel as the water lowered; 2—placing them at the end of a pile trestle carried out into the lake; 3—or on a floating barge; 4—or in a vertical shaft with a horizontal tunnel out to deep water at the bottom; or 5—at the end of a cantilever structure. The last was adopted, and a cantilever built with a 233 ft. arm over the lake and a 154 ft. arm anchored into the rock at the shore end. At the outer end of this were placed six 4200 gpm vertical centrifugal pumps, each with an 18" column 200 ft. long; the columns being tied together with braces at 20 ft. intervals.[E2]

Control of Water Use in Private Premises

A producer and distributor of water for domestic use is responsible for the quality of the water delivered at the premises of the consumers. Generally plumbing and other features of its use on the premises are more or less controlled by the local or state health boards. But the use by the consumer may cause pollution to pass back to the mains and so to other consumers, and it is a duty of the water distributor to prevent this. These objectionable features include cross-connections, back siphonage, corrective treatment by chemicals on the consumer's premises, etc. Solutions from acetylene plants may be forced back into the mains by high pressures, also carbonated water from soda fountains, anti freeze liquids in sprinkler systems, etc. Wherever water is given private treatment of any kind, a system of double check valves and gate valves should be placed at the service meter, using the "factory mutual" type for lines larger than 3", and, for 3" or smaller, check valves of brass or bronze with renewable composition cold-water discs. All these check valves should be tested twice a year and all premises inspected for cross-connections or other dangerous conditions.[A1]

Plumbing standards issued in 1938 by the National Bureau of Standards are now invokable by the U. S. Public Health Service. Wartime trends have increased sanitary defects and health hazards. Defense plants are using a wider variety of poisonous substances in ways which might easily cause backflow into the water system.

In Los Angeles over 10,000 cross-connections have been found in defense plant and military areas. In five areas on the Pacific Coast 18 known instances of water supply pollution from cross-connections and inter-connections have involved thousands of workers in war plants. Definite policies should be formulated to cover 1—Improper uses of water. 2—Use of back-flow protective devices. 3—Distribution system sanitary defects. 4—Methods of protecting siamese connections. 5—Methods of protecting fire lines at pier heads furnishing water from the public system.

Interruptions of street main service from breaks, shut-offs, fire pumping or pressure drops in hilly areas may draw pollution from private premises into the mains. It is the duty of water works operators to shut off all affected services when street mains are shut down for repairs, to provide air inlets in hilly territory to minimize vacuums when mains break or are drained, and to provide back-flow protection on particularly dangerous water services. In Los Angeles a committee was created by the Health, Building and Water Commissions and Board of Mechanical Engineers to determine policies of water supply safety, eliminate sanitary defects, and employ inspectors to enforce compliance with ordinances pertaining to water supply safety.[A2]

Commission-Controlled Water Works Operation

In Ontario Province the electors of any municipality can elect 2 or 4 members of a commission (the head of the municipal council serving as an additional member), each to serve 2 years. The commission then has full control of the construction, operation and maintenance of the system; but it can not issue bonds or borrow money for new construction, and all operating surplus must be paid to the municipal treasurer; such funds to be used for outstanding debts or other purposes of the water works, but if there are no such immediate demands the money can be used to reduce the municipal tax rate. In some cases cities have so used the money even when needed for water works purposes, and have refused to provide funds for constructing works which the commission considered essential. With the exception of this lack of control over its finances, the act has worked out satisfactorily, on the whole.[A10]

Wisconsin statutes provide that, where a public utility is owned by a city, the Common Council *must* create a utility board to manage it, and *may* do so if owned by a town. This board or commission has entire charge and management of the utility. (Where there is the city manager form of government, the city manager assumes the duties of such board.) Each utility must earn sufficient revenue to pay all operating and maintenance expenses, provide for depreciation and pay local taxes; and its funds must be kept separate from those of the municipality. No free water can be furnished to any person or organization. Income in excess of all debts, sinking fund requirements &c. may be used to purchase approved bonds, or may be paid into the general fund. Actual construction work is under the immediate supervision of the Board of Public Works, although the utility generally provides the engineering service.

Replying to a questionnaire sent to 30 of the larger cities of the country, every one operating under a board of water commissioners believed that to be the best type of management, and those not so operating wished they were.[A11]

Prestressed Concrete Pipe

About 75,000 ft. of 30" pipe for water mains has recently been made in Washington, D. C., to withstand heads of 384 to 480 ft.; the pipe consisting of a continuous welded steel cylinder, lined centrifugally with concrete 1⅞" thick, then spirally wound with steel wire under tension. The ends were provided with joints using

steel rings and rubber gaskets following the general Lock Joint Co. design.

The wire used is No. 6 gauge, and while being wound is under a tension of 3,000 lb., or 86,000 psi; its minimum tensile strength being 185,000 psi. The spiral spacing is about 1 in. The concrete lining is mixed 8 bags of cement per cu. yd.; it is applied while the cylinder is revolving 100 rpm and the speed is then increased to 295 rpm. After it has set it is honed with rapidly rotating abrasive blocks. After the wire has been wound, the pipe is covered with ¾ in. of cement mortar wrapped with cotton webbing to protect the wire and steel cylinder.

Two of these pipes were tested to failure, one failing at 655 psi (1450 ft. head), the other at 725 psi; both by the breaking of a strand of the wire. Tested for external load by the three edge bearing method, the first visible crack showed at 6100 lb. per lin. ft. Each pipe was tested for water tightness at 25,000 psi. The 75,000 ft. of pipe required more than 1,000 tons less steel than would have been required for a steel cylinder reinforced concrete pipe, and nearly 2,000 tons less than steel pipe.[E3]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article; *article reviewed in the "Digest."

A *Journal, American Water Works Ass'n*
November
1. Industrial Water Treatment as a Distribution System Hazard. By C. K. Calvert. Pp. 1399-1404.*
2. The Need for Practical Standards. By R. F. Goudey. Pp. 1405-1408.*
3. The U. S. P. H. S. Drinking Water Standards. Symposium by F. H. Waring, G. D. Norcom, R. G. Goudey, C. K. Calvert, C. R. Cox and J. K. Hoskins. Pp. 1409-1436.
4. Women Filter Plant Operators. By Robert L. Stewart. Pp. 1437-1439.*
5. Job Classification in Municipal Water Works. By Albert R. Davis. Pp. 1440-1445.*
6. A Proposed Mechanism for Breakpoint Chlorination. By John R. Rossum. Pp. 1446-1449.
7. Contamination of Water Supplies in Limestone Formation. By S. P. Kingston. Pp. 1450-1456.*
8. Mechanical Joints for Water Lines. By Elson T. Killam. Pp. 1457-1471.*
9. Two New Developments in the Water Conditioning Field. By Samuel B. Applebaum. Pp. 1472-1486.
10. Commission Controlled Water Dept. Operation—Ontario Practice. By William Storrie. Pp. 1487-1491.*
11. Commission Controlled Waterworks Operation in Wisconsin. By L. A. Smith. Pp. 1492-1497.*

D *The Surveyor*
November 5
1. *p.* The Corrosion of Mains in Clay Soils. By H. J. Bunker. Pp. 459-460.
November 26
2. The Amalgamation of Water Undertakings. By Delwyn G. Davies. P. 487.
3. London Water Supply: Effect of County Plan. Pp. 491-492.

E *Engineering News-Record*
December 2
1. *c.* Submarine Water Mains Built in Deep Water. By James R. Gardner. Pp. 78-83.*
2. Cantilever Bridge Supports Pumps at Waterworks Intake. By C. S. Glazbrook. Pp. 86-87.*
December 16
3. Prestressed Concrete Pipe by a New Manufacturing Method. Pp. 83-85.*
4. Improved Method Used to Salvage Big Steel Pipe. Pp. 94-96.

F *Water Works Engineering*
December 1
1. Emergency Treatment of Supply Due to Hurricane (Galveston, Tex.). By Frank M. Stead and Carl A. Nau. Pp. 1334-1337.*
2. De-Salting Sea Water. Pp. 1338-1339.
December 15
3. Novel Hydrant-Testing Device Is Home Made. By Earl E. Norman. Pp. 1386-1388.*

G *Water Works & Sewerage*
November
1. Operating Log for the Small Water Plant. Pp. 401-403.
2. Operation Report Sheet for a Small Water Purification Plant. By A. A. Hirsch. Pp. 403-404.

J *American City*
December
1. Three Clerks and a Calculating Machine. By J. D. Senevey. Pp. 49-50.
2. The Spiractor—What It Can and Can Not Do. By Harry L. Beohner. Pp. 71-72.
3. Wartime Water Rates. Pp. 85, 87.

P *Public Works*
December
1. Trenching and Laying Water Pipe. Pp. 16-19.
2. Development of a Village Water Supply. By I. Russell Riker. Pp. 23-24.
3. Water Supplies for Canadian Aerodromes. Pp. 28, 42.

W *Johnson National Drillers Journal*
November-December
1. Contracting For Well Construction. Pp. 1-7, 10-11, 14.

Keeping Up With New Equipment

Ice Control for Airport Runways

Calcium Chloride Association
4145 Penobscot Bldg., Detroit 26, Mich.

"Ice Control for Airport Runways," is a new information sheet issued by the Calcium Chloride Association, and deals with this problem of winter hazards and the techniques to be followed to overcome these dangers.

Methods on the treatment of abrasives and the use of the chlorides alone, conform with the recommendations on highway practice, made by the Committee on Winter Driving Hazards of the National Safety Council.

Braking performance is from 50 to 65 per cent better if chloride treated abrasives are spread on icy-snowy roads, the Safety Council has reported.

Pilots often have difficulty in winter in braking their ships in time to avoid hitting airplanes on the apron and near hangars, and airport managers have reported planes crashing even into airport buildings and hangars because of icy conditions.

Airport managers say that abrasives alone are of little value because they do not stick to the ice and the propeller wash blows the sand or cinders away.

Greater care, too, is being taken at airports used by commercial airlines, to insure safe walking from ramps to stations by passengers when icy conditions exist. Ask for a free copy of the information sheet.

With a standard hook on upper edge of shovel bucket or dozer blade, the Dozershovel operates also as a lifting crane.

Two-In-One "Dozershovel"

Bucyrus-Erie
South Milwaukee, Wis.

With a record of extensive service in the armed forces for whom it was designed and manufactured, a new two-in-one dirt moving unit—the DOZERSHOVEL for T9 and TD9 International TracTracTors—is announced because production in excess of military demands makes limited numbers of this unit available for civilian use under government release.

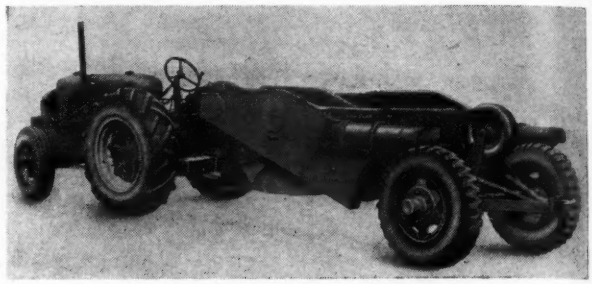
The unique design of the Dozershovel provides completely for full-fledged tractor shovel and bulldozer service, with simple interchangeability of bucket and blade permitting changeovers in the field in a few minutes. As a shovel, the unit's hydraulic control provides down pressure up to 4200 pounds for real digging "bites" and big pay loads in a short distance of travel. The same control on the bulldozer provides easy penetration in hard materials and ability to hold the cut. Strong side arms permit the shovel to lift big loads, the dozer to handle any dirt-dozing job. The unit's dumping trip-mechanism gives a dozer a feature unmatched in other bulldozers: ability to tip the blade forward to release the load on uphill dozing.

Other features include unobstructed visibility, low overhead clearance, oscillating tracks and quick, high lift.

Its traveling height of only 8′ 1½″ allows it to get in and out of buildings, to work in close quarters, to be transported on trailers eliminating unnecessary route-planning to avoid underpasses. It has oscillating tracks for stability on uneven ground, and high lift for fast work in loading trucks.

An additional feature is the standard hook on the upper edge of the shovel bucket or dozer blade, giving the unit a third application; lifting crane service.

Detailed information on the Dozershovel can be obtained by writing the manufacturers.



LaPlant-Choate Airborne Scraper.

A New Airborne Scraper

LaPlant-Choate Mfg. Co.
Cedar Rapids, Iowa

Developed especially for use by the U. S. Airborne Aviation Engineers but adaptable to many peacetime applications, this unit is a small pocket-size edition of 1¾ cu. yard struck capacity, or 2 cu. yards heaped capacity. The rear of the frame is so constructed that the rear wheels can be located either inside or outside the width of the cut. Efficient design enables the scraper to make a full 90° turn or less within a circle diameter of 20 feet without overturning.

The present airborne scraper is designed to be pulled by tractors employed by the airborne engineers. After the war it will be ideally suited for use with the small Caterpillar D-2 tractor although its size will be increased proportional to the tractor. Because of its light weight design and low price, it will provide an effective tool for landscape work, construction of ponds for water conservation, maintenance work, stripping soil, cleaning and constructing ditches on country roads and many other jobs where a small, light-weight tractor-scraper unit is desirable.

Both the bowl and apron of this model are hydraulically operated by LaPlant-Choate's newly designed hydraulic system. The hydraulic pump is located on and driven by the tractor, while two double acting jacks control movement of the scraper bowl and apron. A three-position valve raises, lowers, and holds the cutting edge in position, and exerts the necessary down pressure for effective operation. By means of this down pressure the total weight of the scraper can be placed on the cutting edge to force the machine to dig. The same force regulates the cut from 0 to 6½″. The rear wheels can be placed inside the cut to produce smooth finished work.

A request to the manufacturers will bring complete information.

New Design Manual for Timber Connector Construction Will Aid Engineers and Architects

Designers who are using the timber connector method of construction will find extremely valuable the new *Design Manual for Teco Timber Connector Construction* just issued by the Timber Engineering Company, of Washington, D. C., the manufacturers of Teco connectors and grooving tools.

The 40-page book offers complete design information covering the use of Teco connectors, including data on load values, spacings, etc. The material is presented in chart form for ready use of architects and engineers and includes such additional information as recommended cambers for standard trusses, approximate weights of various timber connectored roof trusses and a table of dimensional properties of American standard-sized lumber.

The data presented is drawn in accordance with the recent WPB *National Emergency Specifications for the Design, Fabrication, and Erection of Stress Grade Lumber and Its Fastenings* which became mandatory on November first. Write Timber Engineering Co., 1319 Eighteenth St. N.W., Washington 6, D. C., for a copy of this Design Manual.

Proportioning Equipment for Corrosive Fluids

Cochrane Corporation
17th & Allegheny Ave.
Philadelphia 32, Pa.

Cochrane Publication 2985-A describes an ingenious and simple method of proportioning sulphuric acid to water supplies. Accuracy is obtained without the use of any moving parts in contact with the corrosive liquid.

The principle of operation is described fully, with its many advantages and applications in this publication, which can be had upon request.

The "Magna-Bond"

Fischer & Porter Co.
County Line Road
Hatboro, Pa.

"Magna-Bond" was developed for all types of flow rate measurement where fluids are too opaque, or the temperatures and pressures too high, or where the service is too hazardous to permit the use of direct reading rotameters and electrically operated control instruments. Basically it is a rotameter consisting essentially of a tapered pyrex metering tube within which a float travels up and down and assumes a position in direct proportion to the flow rate. To this float, an extension containing a transmitting magnet is attached. Through a strong magnetic "bond" an external fork accurately follows the transmitting magnet as it moves up and down within a well above the metering tube. The movement of the float is thus carried to the outside instrument which may be an indicator or recorder, or a pneumatic "Rotamatic" controller for complete automatic control. In this way all the advantages of the rotameter for flow rate measurement, including high accuracy, linear calibration and wide flow range remain inherent through the "Magna-Bond." The absence of a stuffing box and the ability to compensate for a wide variation in viscosity caused by changes in chemical composition and temperature make the "Magna-Bond" the ideal instrument for metering, recording and totalizing the flow of many types of fluids. Further information about the "Magna-Bond" may be had by writing for catalog 50-A.

District Warehouses for Griffin Wellpoint

The Griffin Wellpoint Corporation, manufacturers of Griffin Wellpoint Systems for dewatering and water supply, high pressure jetting pumps, portable fire pumps and oil pumping equipment, and their associate, the Griffin Equipment & Supply Corporation, manufacturers of gasoline and diesel engine-driven generator sets, lighting plants, portable floodlighting equipment, and gasoline and diesel engine-driven marine auxiliary sets, have arranged for the distribution of these products through warehouse stocks maintained at the following locations:

Southern District—Griffin Engineering Corporation, 633 North Myrtle Avenue, Jacksonville 4, Florida.

Mid-west District—Griffin Engineering Corporation, 548 Indiana Street, Hammond, Indiana.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 53-57*

Manual for Water Works Operators

Prepared by
The Texas Water Works and Sewerage Short School

Many new features and 106 pages have been added to the revised edition of the *Manual for Water Works Operators* prepared by the Texas Water Works and Sewerage Short School. The new edition is a handbook for the water works operator with a complete treatment of the subject.

The new features include more illustrations; more complete information on measuring water flows; a practical discussion on the servicing and maintenance of domestic meters; helpful directions on the analysis of odor control; practical treatment of the relationship of algae conditions to water supplies; the latest developments in chlorination and water softening; statement of the Anti-Stream Pollution Regulation of the Texas State Department of Health. By special permission of the United States Public Health Service the 1942 Public Health Service Standards and Manual of Recommended Water Sanitation Practice are reprinted as a part of this Manual.

The 23 authors have brought their respective chapters up-to-date and the material has been compiled under the direction of the Manual Committee of the Texas Water Works and Sewerage Short School consisting of L. C. Billings, Chairman; V. M. Ehlers, W. S. Mahlie, D. W. Robinson and Walter Hicks.

The book is priced at $3.00 per copy and may be obtained by writing to Mrs. Earl H. Goodwin, Assistant Secretary-Treasurer, Texas Water Works and Sewerage Short School, c/o State Health Department Building, Austin, Texas.

Principles of Highway Construction as Applied to Airports

Public Roads Administration
Washington, D. C.

To meet demand now and in the post-war "air era" for information on the construction of airport runways, this manual has just been published by the Public Roads Administration of Federal Works Agency. It consists of more than 500 pages of text and specifications, illustrated with 60 line drawings and 33 halftones. Copies are available only by purchase from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. The price is $1.00. There is no free supply.

The manual discusses grading, drainage, and design and construction of all the ordinary types of highway surfaces. All material is presented ready for practical application by the engineer in the field.

One feature that adds much to the value of the book is material on soil sampling, testing, identification and classification and on the practical application of such data in fill construction and in the construction of soil bases and surfaces. The publication makes available to field engineers for the first time, a complete manual on soil testing and application of test data. Methods of designing soil mixtures are illustrated by actual examples.

Fairbanks-Morse Announces Changes in Personnel

O. O. Lewis, formerly Branch Manager, Atlanta, Ga., has been promoted to the position of Assistant General Sales Manager of the company, Chicago.

G. N. Van Epps, formerly Manager of the Diesel Department, Chicago Branch, has been promoted to Manager of Branch at Atlanta, Ga.

V. O. Harkness, former Manager of the company's Branch at Dallas, Texas, has been appointed Manager of the Diesel Engine Sales Division, Chicago.

J. S. Peterson, formerly Scale Department Manager of the Cincinnati Branch, has been promoted to the office of Branch Manager replacing the late Mr. Stanley Eaton.

Texas Water Works and Sewerage Short School

Plans have been made for the holding of the 26th Annual School at Texas A. & M. College, College Station, Texas, January 31 through February 2, 1944.

The three full days will be devoted to discussions on such important topics as recent developments in priorities, the function of the Office of War Utilities, use of idle equipment, manpower problems, post-war planning, the U. S. Public Health Service Standards for drinking water, water supply security, in-service training of water and sewage plant operators, the latest developments in the relation of poliomyelitis transmission and sewage, as well as the relation of Army and Navy standards to the operation of municipal utilities, and new developments in the various fields. Several national authorities have already indicated their plans to appear on the program.

New Sight Flow Indicator Using Rotameter Principle

Fischer & Porter Co.
County Line Road
Hatboro, Pa.

The "Rota-Sight" for flow indication in any application where an approximation of the amount of flow rate is an operating aid and necessity. This simply constructed flow indicator clearly shows when a liquid or gas is passing through a line. It has an indicating float which moves up and down in a pyrex tube in direct proportion to the amount of flow. Instantaneous response to flow change is obtained by the uniquely designed pyrex tube into which triangular V-ported flutes are formed. As a result, a variable area meter is obtained giving a wide range over a short scale length.

The metering tube is only "3" overall and the fittings are hollow so that flow may pass through them.

The "Rota-Sight" may be equipped with an alarm which is a positive and inexpensive device for visible or audible protection against dangerously low or high flows. This action is accomplished by means of a magnetic float extension which trips a magnetic switch to operate the alarm circuit. High and low alarm positions are adjustable over the entire flow range of the instrument.

An interesting leaflet, Bulletin 92-A, explaining the "Rota-Sight" in detail and giving dimensions, flow rates, and maximum operating pressures will be sent, without obligation, at your request.

A Technical Manual for the Rescue Service

This 150-page well-illustrated volume describes the important technical apparatus and operations which are necessary in rescue work. War from the air accompanied by widespread bombing of civilian populations brings with it the problem of rescuing casualties from the debris of demolished buildings. To every bombing incident where casualties are trapped, rescue squads must be dispatched to release them and if such services are not provided, or should they prove inadequate, men, women and children will die needlessly and the morale of the people may be severely shaken. For these and other obvious reasons, the Rescue Section, Medical Division of the U. S. Office of Civilian Defense has prepared this valuable manual. The price is 20¢ per copy. Orders should be addressed to: The Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Koehring Holds Sales Conferences

Koehring Company and its subsidiary companies, Kwik-Mix Concrete Mixer Company, Port Washington, Wis., Parsons Company, Newton, Iowa, and the C. S. Johnson Company, Champaign, Ill., recently held a series of regional sales conferences at Roanoke, Va., Atlanta, Ga., Dallas, Salt Lake City, and Chicago. J. R. Steelman, Vice President, Koehring Company, is in charge of sales of all companies, George J. Dimond in charge of Koehring

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 53-57*

sales, A. E. Kelbe in charge of Kwik-Mix sales, H. J. Holdsworth in charge of Parsons sales and J. F. Robbins in charge of Johnson sales.

Public Roads Administration Federal Works Agency

Advance Engineering Projects
As Provided for by Section 9, Defense Highway Act of 1941

Programs for advance engineering projects authorized by the Defense Highway Act of 1941 have been approved by the Public Roads Administration as of November 10, 1943 in 41 States and the District of Columbia.

Under the above heading a description, location and length of each project are given by states. It occupies 28 mimeographed pages 8½ x 11. To illustrate, the first item under Alabama is: "A new route between a point southeast of Centerville and a point northwest of Brent, involving a route around Centerville and a new bridge over the Cahaba River. Length 4.5 miles."

If a complete copy is desired, address Public Roads Administration, Federal Works Agency, Washington, D. C.

James B. Clow & Sons, Chicago

Announce the opening of a sales office at 2 Rector St., New York 6, N. Y., Room 434. Telephone: Bowling Green 9-6659. Henry E. Skibbe, Manager.

New Pemco-Nordstrom Offices Opened in Atlanta, Ga.

The Southeastern office of Pittsburgh Equitable Meter Co. and Merco Nordstrom Valve Co., formerly located in Memphis, Tenn., has been moved to 411 Bona Allen Building, Spring and Luckie Streets, Atlanta, Ga. C. C. Moore, who has been in charge of the Memphis office, is District Manager.

Compound Duplex Filter Blocks

F. B. Leopold Co., Inc.
422 First Ave., Pittsburgh 19, Pa.

Built entirely of Fire Clay the Leopold Filter Blocks for Water Filtration plants each cover approximately two square feet of filter floor which divides the filter bed into sections for more positive operation. The blocks are made unitary and combine the laterals or primary system with the distributor or secondary system.

After the blocks are pressed they are cut to exact length desired and are perforated as per specifications, then stored for slow drying in warm, moist air. After blocks are practically dry they are placed in a kiln, salt glazed and burnt for several days under at least 2000° F. until they are thoroughly vitrified, hard, smooth and straight.

Being made of glazed and vitrified material these blocks are impervious to acid or alkali solutions and will not absorb water to a detrimental extent. A folder giving full information and installation drawings is available by writing the manufacturers.

American Road Builders' Association to Hold 41st Annual Convention in Edgewater Beach Hotel in Chicago, Feb. 1-3

The meeting will be largely devoted to the shortages of material, repair parts and manpower; postwar highway construction; and the postwar construction equipment problem.

Check the dates on your calendar—Feb. 1, 2 and 3. President's Dinner, Feb. 3rd. And make your hotel, train and dinner reservations early!

A major problem of vital interest to members of the Association is that of postwar construction equipment. Whether there will be dumping of equipment by the Army or Navy, whether there will be any to dump, and whether the factories will be able to reconvert quickly, are among the phases of the problem to be discussed by the best authorities obtainable.

Here's "Old Ironguts," the first shovel ever built by The General Excavator Company, of Marion, Ohio, 17 years ago, and still in service for the Scioto Lime and Stone Company, Delaware, Ohio. Beside the veteran shovel are W. A. Reaney (right), general manager of Scioto, and operator Verne Andrew (left), who has been "on the job" with General Excavator and Osgood equipment for 25 years.

Davey Compressor Co. Appoints New Distributors

Curry Equipment Corporation, 1435-7 N. 31st St., Philadelphia 21, Pa., has been made a franchise dealer for Davey Portable and Industrial Compressors, Truck Power Take-Offs and Pneumatic Saws.

This corporation, headed by Glenn M. Curry, president, serves Eastern Pennsylvania, Southern New Jersey, Delaware and adjacent territory and will further improve service to Davey owners through a stock of parts to be maintained at Philadelphia and make localized advice available to prospective users of Davey Compressors, Pnuematic Saws and Power Take-Offs.

The E. H. Kliebenstein Company, 856 East 136th St., New York, N. Y., added the line of Davey Portable and Industrial Compressors, and other products in preparation for extensive post-war construction activity.

E. H. Kliebenstein, general manager of the firm, was formerly eastern sales manager for the Link-Belt Speeder Corporation and enjoys a wide reputation among eastern contractors.

The Company will carry a stock of parts and render service on the various types of equipment manufactured by Davey Compressor Company.

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Readers' Service Department

These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Bridges

7. Teco Connectors, a new method of structural engineering, to spread the load on a timber joint more equally over the cross-section of the wood is described in new literature available from Timber Engineering Co., Dept. BS-2, 1319—18th St., N. W., Washington, D. C.

Cold Mix Plants

15. New catalogs and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

Cold or Wet Weather Construction

18. Cleaver Aggregate Heaters and Dryers, Hot Water Boosters, and Automatic Steam plants are designed to speed up cold or wet weather construction. Write for illustrated bulletins. Cleaver-Brooks Co., 3112 W. Center St., Milwaukee, Wis.

Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Concrete Curing

33. 64-page manual of concrete curing with calcium chlorides. Complete, handy. Contains useful tables, well illustrated. Write the Columbia Chemical Division, Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.

Concrete, Early Strength

38. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

Graders, Patrol

105. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Road Machinery Co., Aurora, Ill.

Mixing Plants, Asphalt

106. The Cleaver Asphalt Mixing Plant for an inexpensive plant mix and the Cleaver Tank Car Heater and Bituminous Booster are covered in illustrated catalogs sent on request by Cleaver-Brooks Co., 3112 W. Center St., Milwaukee, Wis.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Oil, Motor

109. "Here's Proof of Ring-Free Superiority," 32 pages, illustrated, outlines the principles of lubrication and explains how by simple tests you can measure the advantages of Macmillan Ring-Free Motor Oil. Write Macmillan Petroleum Corp., 530 West 6th St., Los Angeles, Calif.

Paving Materials, Bituminous

111. New "Tarvia Manual" is packed with useful data on how to build and maintain roads with Tarvia. Each step is illustrated with excellent action pictures, 64 pp. 103 ills. Write to The Barrett Div., 40 Rector St., New York, N. Y.

Pumps

120. Interesting new booklet tells how to lengthen the life of your pumps. Explains how a little care will save a lot of wear. Write today for your copy. Homelite Corp., 2403 Riverdale Ave., Portchester, N. Y.

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121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

Road Building and Maintenance

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Gallon Iron Works & Mfg. Co., Gallon, Ohio.

129. Warco Hydraulic Control Motor Graders, Duplex Hydraulic Scoops and Whizzard, easily transported, rollers are described and illustrated in literature available from W. A. Riddell Corp., Bucyrus, Ohio.

Rock Drill Maintenance

130. New booklet presents through amusing cartoons useful hints on proper rock drill maintenance methods—what your men can do to get more work out of your tools with a minimum of expense for repairs and compressed air. Write The Cleveland Rock Drill Co., 3734 East 78th St., Cleveland, Ohio.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller 3-axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

140. This well-illustrated 16-page catalog describes the tandem, autocrat, cadet, and roll-a-plane rollers, and explains what each is intended to accomplish. Write Austin-Western Road Mach. Co., Aurora, Ill.

Rotproofing

145. Cuprinol, a rotproofing chemical that protects wood from fungi and insects, yet has no offensive odor, is non-poisonous, does not corrode metal and can be painted over. Get full details in booklet from Cuprinol, Inc., 7 Water St., Boston, Mass.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Chemical Division will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Chemical Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.

154. "Soil Stabilization with Tarvia"—An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Div., 40 Rector St., New York, N. Y.

155. Sterling Rock Salt for Frost Damage Prevention. Sterling Rock Salt for Base and Surface Stabilization. Two descriptive bulletins issued by International Salt Co. Inc., Scranton, Pa.

Spreader

187. Jaeger Paving equipment, including Mix-in-Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Surface Consolidation and Maintenance

188. Detailed and illustrated presentation of the method and procedure in consolidated operations; explains how sub-soils can be conditioned to resist softening and frost action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Timber Structures

189. "Typical Designs of Timber Structures" contains plans for 45 representative structures that have been engineered with Teco Connectors. For free copy write Timber Engineering Co., Inc., Room 6GG, 1319—18th St., N. W., Washington, D. C.

Wellpoints

195. New complete catalog, "Griffin Pointed Wellpoint Facts," just issued. Covers pre-drainage, describing wellpoints jetting pumps, with tables, diagrams and illustrations. Griffin Wellpoint Corp., 881 E. 141st St., New York.

Street and Paving Maintenance

290. "Blacktop Road Maintenance and Construction Equipment"—Asphalt and tar kettles, flue type kettles, spray attachments with completely submerged pumps, tool heaters, surface heaters, road brooms, portable trail-o-rollers, etc. These are all described in detail and illustrated. This modern and up-to-date equipment for blacktop airport and road construction and maintenance is based upon experience and engineering research over a period of 42 years. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, O.

Fire Apparatus

300. Detailed information and advice about specially engineered Ward LaFrance apparatus will be sent on request. Ward LaFrance Div., Elmira, N. Y.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Div., Wyandotte Chemicals Corp., Wyandotte, Mich., tells how to use calcium chloride for modern ice control.

352. Ice Prevention on Highways, Streets, and Airport Runways with Sterling "Auger Action" Rock Salt. An illustrated bulletin issued by International Salt Co. Inc., Scranton, Pa.

Sanitary Engineering

Aero-Filter

356. Aero-Filter Design Data is given in a new 32-page catalogue. It contains information on Advantages of Aero-Filter Process, Single Stage vs. Multi Stage Treatment, Filter Loadings, Rates of Flow and Results, Filter Depths, Recirculation, Sewage Pumps and Pump Control. Approximately 15 pages of blue prints are included in this instructive catalogue. Write Lakeside Engineering Co., 222 W. Adams St., Chicago, for a copy.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6701 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20 pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Blowers

370. All interested in low cost air for sewage disposal will want a copy of this catalog describing operating principles and specifications of Roots-Connersville Aerating Blowers. Write to Roots-Connersville Blower Corp., 301 Valley Ave., Connersville, Ind.

Chlorinators, Portable

379. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark 1, N. J.

380. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from Proportioneers, Inc., 96 Codding St., Providence, R. I.

Cleaning Sewers With Own Forces

385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boul., Los Angeles, Calif.

Consulting Engineers

389. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

Feeders, Chlorine, Amonia and Chemical

392. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

393. New circular describes and illustrates the Var-I-Feeder, a new portable chemical feeder for water main sterilization, military use or other chemical treatment. Write Chem-Feeds, Inc., 77 Reservoir Ave., Providence, R. I.

394. Everson Sterelators for all kinds of chemical feeding in stationary and portable models are described in new bulletins issued by Everson Manufacturing Co., 214 West Huron St., Chicago 1, Ill.

399. Hulsafeeders. A flow-proportional liquid chemical feeder, reciprocating type, fluid motor driven. Operating parts completely isolated from the chemical being fed. Micrometer adjustment. For feeding against high or low pressure. Wilson Chemical Feeders, Inc., 211 Clinton St., Buffalo 4, N. Y.

Filters

402. How to increase the capacity of filters through use of Anthrafilt and complete data on use of Anthrafilt for filters and sludge beds is contained in a revised pocket Manual issued by Anthracite Equipment Corp. For free copy write H. G. Turner, State College, Pa.

Fire Hydrants

405. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M & H Valve & Fittings Co., Anniston, Ala.

406. See listing No. 436.

407. Fire hydrants which are floodproof, easy to operate and service are described in Rensselaer Bulletin W., formerly known as "Coreys." Address: Rensselaer Valve Co., Troy, N. Y.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Gas Holders and Digesters

411. Digesters and Gas Holders for efficient collection and storage of sewage gas are described in an interesting illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago, Ill.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

414. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

415. See listing No. 436.

416. Check valves of the Clear-Way, Quiet-Closing type which eliminate "Slam" are described in Rensselaer Bulletin V. Made in expanding outlet type, as well as straight-thru type, for bolting direct to pump discharge. Address: Rensselaer Valve Co., Troy, N. Y.

Gauges

421. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Laboratory Equipment

423. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 80-page booklet. W. A. Taylor & Co., 7301 York Road, Baltimore, Md.

Manhole Covers and Inlets

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders-Providence, Inc., Codding St., Providence, R. I.

433. "The Selection of Main Line Meters," a highly informative and useful presentation prepared by a competent engineer, J. C. Thoresen, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence, R. I.

Pipe, Cast Iron

435. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York 16, New York.

436. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

437. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

Pipe, Lock Joint

440. Lock Joint Reinforced Concrete Sewer Pipe. Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

Pipe, Transite

442. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints Sewer

444. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

Pipe Joint Compounds

446. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps and Well Water Systems

449. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

450. Peerless pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth are described and illustrated in new literature that clearly shows their construction and special features. Write Peerless Pump Div., Food Machinery Corp., 301 W. Ave. at 26th St., Los Angeles, Calif.

451. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill.

Meter Setting and Testing

454. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Screens

456. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

Sludge Drying and Incineration

458. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 205-P East 42nd St., New York 17, N. Y.

459. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

460. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes—a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Softening

462. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

463. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

466. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

468. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Taste and Odor Control

470. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y.

471. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

475. Three types of clarifiers for sewage treatment are illustrated and described in a new bulletin issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago, Ill.

476. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

477. All-steel Rotary Distributors, correctly designed for the small and medium sized sewage plants, are the subject of a new, well illustrated booklet issued by Graver Tank & Mfg. Co., 332 South Michigan Ave., Chicago, Ill. This booklet also covers distributors for various types of high-rate trickling filters.

478. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

479. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

480. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

481. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

483. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

484. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

485. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York 22, N. Y.

487. The complete line of Jeffrey equipment for water, sewage and industrial wastes treatment is illustrated and described in a handsome, new, 40-page catalog just issued by The Jeffrey Mfg. Co., 947-99 North Fourth St., Columbus 16, Ohio.

488. "Packaged" Sewage Treatment Plants, specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., Dept. PW, 2300 Wolfram St., Chicago 18, Ill.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh, Pa., for free copy.

Valves (See Gates, Air Release, etc.)

Water Treatment

495. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago, Ill., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

496. "Use of copper sulphate in water treatment plants" titles informative booklet, with valuable data on chemicals, dosage, etc. Write Tennessee Corporation, Atlanta, Ga.

497. Ferri-floc Ferric Sulphate — a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennssee Coporation, Atlanta, Ga.

Water Service Devices

500. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati, Ohio.

Ray S. Wood

Link-Belt Company Acquires a Manufacturing Plant in Minneapolis

Link-Belt Company has purchased the manufacturing plant and inventory of Link-Belt Supply Company in Minneapolis.

Link-Belt Supply Company had worked very closely with Link-Belt Company since around 1900, having in all this time served as an authorized distributor of Link-Belt Company products in Minneapolis, St. Paul, and the adjacent territory.

The entire Minneapolis organization will be retained, present manufacturing facilities will be improved, and stocks are to be expanded as rapidly as possible.

Ray S. Wood, the new plant manager, started his Link-Belt Company career in 1914, in the engineering department at the company's plant in Philadelphia.

NEW APPOINTMENTS

New City and County Officials recently reported:

City Engineers

F. G. Hocutt, Tuscaloosa, Ala.
Thomas S. Burgess, S. Windsor City, Conn.
Arthur D. Millard, Hammond, Ind.
O. E. Gartzke, Iowa City, Ia.
Earl Hougland, Beloit, Kans.
Charles Spaulding, Portsmouth, N. H.
Leonard Johnson, Alamo, Texas
Ben B. Lummis, Casper, Wyo.

City Manager

H. J. Henrikson (Acting), Gladstone, Mich.

Water Works Superintendents

James M. Fouch, Colusa, Calif.
George E. Blevins, Delta, Colo.
Louis G. Forrler, Gillespie, Ill.
A. C. Jantzen, Jacksonville, Ill.
Willie B. Prather, Madison, Ind.
Nickolas Beumel, Jr., Tell City, Ind.
Chris Neilsen, Red Oak, Ia.
C. W. Atchison, Anthony, Kans.
Vitas Hromek, Arma, Kans.
D. Underhill, Baxter Springs, Kans.
J. M. Shaw, Blue Rapids, Kans.
Robert William Glasheen, Athol, Mass.
Baxter F. Wade, Jackson, Miss.
Lloyd J. Scherich, Superior, Nebr.
Howard MacMillin (Acting), Boro of Haddonfield, N. J.
Edward Tschida, Dickinson, N. D.
E. M. Armstrong, Vancouver, Wash.
C. L. Stuart, Moundsville, W. Va.
P. E. Widsteen, Menasha, Wis.

County Engineers

R. F. McKay, Fayette Co., Uniontown, Pa.

ADVERTISERS

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